18785

Class

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TRANSACTIONS

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

SIXTH SESSION,

HELD AT NEW YORK CITY,

SEPTEMBER 20, 21, AND 22, 1892.

VOLUME V.

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PHILADELPHIA:
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1893.

NOTE.—The Association assumes no responsibility for the statements or opinions published in this volume.

The Publication Committee regrets that this volume must go to press on February 15th without six papers that were read at the meeting.

The Committee acted in accordance with By-law, Article VII., Section 4.

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LIST OF OFFICERS.

[Elected September 22, 1892.]

PRESIDENT.

A. J. STEELE, M.D.

VICE-PRESIDENTS.

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ARTHUR J. GILLETTE, M.D.

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A. B. JUDSON, M.D.

SECRETARY.

JOHN RIDLON, M.D.,
34 Washington Street, Chicago.

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H. HODGEN, M.D.

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The President, the Treasurer, and the Secretary.

PUBLICATION COMMITTEE.

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H. AUGUSTUS WILSON, M.D.

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NEWTON M. SHAFFER, M.D.
Alternate: AP MORGAN VANCE, M.D.

LIST OF PRESIDENTS.

1887. V. P. GIBNEY, M.D.
1888. NEWTON M. SHAFFER, M.D.
1889. E. H. BRADFORD, M.D.
1890. DE FOREST WILLARD, M.D.
1891. A. B. JUDSON, M.D.
1892. BENJAMIN LEE, M.D.
1893. A. J. STEELE, M.D.

MEMBERS.

* Original Members.
† Deceased.

1889. Bartow, Bernard, M.D. Clinical Professor of Orthopedic Surgery in the Medical Department of the University of Buffalo. 220 Franklin Street, Buffalo, N. Y.

1892. Blanchard, Wallace, M.D. 34 Monroe Street, Chicago.

*1887. Bradford, E. H., M.D. Visiting Surgeon to the Boston City, the Children's, and the Samaritan Hospitals; Instructor in Clinical Surgery in Harvard Medical School. *Vice-President*, 1888 *President*, 1889. 149 Newbury Street, Boston.

1889. Brackett, E. G., M.D. Assistant Surgeon to Out-patients, Children's Hospital; Physician to the Department for Nervous Diseases, Boston Dispensary; Assistant to the Department for Nervous Diseases, Boston City Hospital. 149 Newbury Street, Boston.

*†1887. Brown, Buckminster, M.D.

*1887. Brown, Dillon, M.D. 40 East Fifty-seventh Street, New York.

*1887. Bryant, Joseph D., M.D. Professor of Anatomy and of Clinical Surgery, and Associate Professor of Orthopedic Surgery in Bellevue Hospital Medical College; Visiting Surgeon to Bellevue and St. Vincent Hospitals; Surgeon-General National Guard S. N. Y. 54 West Thirty-sixth Street, New York.

1889. Burrell, Herbert L., M.D. Surgeon to the Carney and Children's Hospitals; Surgeon to Out-patients, Boston City Hospital; Demonstrator of Surgical Appliances, Harvard University. 22 Newbury Street, Boston.

1891. Cook, Ansel G., M.D. 55 Church Street, Hartford, Conn.

*†1887. Develin, Edward, M.D.

*1887. Foster, Charles C., M.D. Orthopedic Surgeon to the Cambridge Hospital. 5 Riedesel Avenue, Cambridge, Mass.

*1887. Gibney, V. P., M.D. Professor of Orthopedic Surgery in the New York Polyclinic; Surgeon-in-chief to the New York Hospital for Ruptured and Crippled; Orthopedic Surgeon to the Nursery and

Child's Hospital, New York. *President*, 1887. *Vice-President*, 1889. 16 Park Avenue, New York.

1889. Gillette, Arthur J., M.D. Visiting Orthopedic Surgeon to University Dispensary; and Orthopedic Surgeon to St. Luke's Hospital, St. Paul. 301 Pleasant Avenue, St. Paul, Minnesota. *Second Vice-President*, 1893.

1892. Goldthwait, Joel E., M.D. Attending Physician to St. Luke's Convalescent Home; Visiting Surgeon to the Good Samaritan Hospital, Boston. 719 Boylston Street, Boston.

*1887. Goodman, H.E., M.D. Attending Surgeon to the Orthopedic Hospital. 1509 Walnut Street, Philadelphia.

1892. Griffith, J. D., M.D. Professor of Surgery, Kansas City Medical College; Surgeon to All Saints, St. Joseph's, Children's, and German Hospitals; President of the State Board of Health; Surgeon-General National Guard S. Mo. S. W. corner Ninth and Grand Avenue, Kansas City, Missouri.

1892. Hoadley, A. E., M.D. Professor of Orthopedic Surgery and Surgical Diseases of Joints, Chicago Polyclinic; Professor of Orthopedic Surgery and Surgical Diseases of Joints and Clinical Surgery, College of Physicians and Surgeons, Chicago. 683 Washington Boulevard, Chicago.

*1887. Hodgen, Harry, M.D. 2604 Locust Street, St. Louis.

*1887. Judson, A. B., M.D. Orthopedic Surgeon to the Out-patient Department of the New York Hospital. *Vice-President*, 1890. *President*, 1891. *Treasurer*, 1893. 38 East Twenty-fifth Street, New York.

*1887. Ketch, Samuel, M.D. Senior Assistant Surgeon to the New York Orthopedic Hospital; Surgeon to the Randall's Island Hospital; Clinical Professor of Orthopedic Surgery in the New York Woman's Medical College. *Corresponding Secretary*, 1887 to 1891. *First Vice-President*, 1893. 328 West Twenty-ninth Street, New York.

*1887. Lee, Benjamin, M.D. Secretary of the State Board of Health of Pennsylvania; Professor of Orthopedics in the Philadelphia Polyclinic and College for Graduates in Medicine. *Vice-President*, 1889. *President*, 1892. 1532 Pine Street, Philadelphia.

*1887. Lovett, Robert W., M.D. Surgeon to the Samaritan Hospital; Assistant Out-patient Surgeon to the Children's Hospital; Out-patient Surgeon to the Carney Hospital. *Secretary*, 1889. 379 Boylston Street, Boston.

1889. McKenzie, B. E., M.D. Lecturer on Orthopedic Surgery in the Woman's Medical College; Consulting Orthopedic Surgeon to

the Hospital for Sick Children, Toronto. 14 Bloor Street, West, Toronto, Canada.

*1887. Moore, James E., M.D. Professor of Orthopedic Surgery in the University of Minnesota; Orthopedic Surgeon to St. Mary's Hospital; Consulting Surgeon to the Northwestern Hospital for Women and Children. 125 Fourth Street, South, Minneapolis, Minn.

1889. Myers, T. Halsted, M.D. Orthopedic Surgeon to St. Luke's Hospital; Assistant Surgeon to the New York Orthopedic Dispensary; Surgeon to the Presbyterian Hospital Dispensary. 24 West Fiftieth Street, New York.

*1887. Packard, George B., M.D. Professor of Orthopedic Surgery in the University of Colorado. 1405 Stout Street, Denver.

*1887. Park, Roswell, M.D. Professor of Surgery in the Medical Department of the University of Buffalo; Surgeon to the Buffalo General Hospital; Consulting Surgeon to the Fitch Accident Hospital and the Buffalo Eye and Ear Infirmary. 510 Delaware Avenue, Buffalo, N. Y.

1890. Phelps, A. M., M.D. Professor of Surgery in the University of Vermont; Professor of Orthopedic Surgery in the University of the City of New York, Medical Department; Professor of Orthopedic Surgery in the Post-Graduate Medical School and Hospital; Visiting Surgeon to the Charity Hospital, New York; Consulting Surgeon to the Mary Fletcher Hospital, Burlington, Vt. 40 W. Thirty-fourth Street, New York.

*1887. Ridlon, John, M.D. Lecturer on Orthopedic Surgery in the Northwestern University Medical School; Professor of Orthopedic Surgery in the Post-Graduate Medical School of Chicago. *Secretary and Treasurer*, 1891 and 1892. *Secretary*, 1893. 34 Washington Street, Chicago.

*1887. Roberts, A. Sydney, M.D. 1901 Walnut Street, Philadelphia.

*1887. Ryan, George W., M.D. Clinical Lecturer on Orthopedic Surgery in the Medical College of Ohio. *Secretary*, 1890. *Vice-President*, 1891. 114 W. Ninth Street, Cincinnati.

1889. Sayre, Lewis A., M.D. Professor of Orthopedic Surgery in the Bellevue Hospital Medical College; Consulting Surgeon to the Bellevue Hospital, the Charity Hospital, and the Home for Incurables. 285 Fifth Avenue, New York.

*†1887. Sayre, Lewis Hall, M.D.

*1887. Sayre, Reginald H., M.D. Assistant to the Chair of Surgery in Bellevue Hospital Medical College; Orthopedic Surgeon

to the Out-door Department of Bellevue Hospital. *Vice-President*, 1892. 285 Fifth Avenue, New York.

*1887. Schapps, John C., M.D. Orthopedic Surgeon to St. Mary's Hospital Dispensary, Brooklyn. 486 Bedford Avenue, Brooklyn.

1889. Scudder, Charles Locke, M.D. Assistant in Surgery in Harvard University; Surgeon to the Out-patient Department of Massachusetts General Hospital. 94 Charles Street, Boston.

*1887. Shaffer, Newton M., M.D. Attending Surgeon-in-charge of the New York Orthopedic Hospital and Dispensary; Consulting Orthopedic Surgeon to St. Luke's Hospital; Consulting Surgeon to the New York Infirmary for Women and Children. *President*, 1888. 28 E. Thirty-eighth Street, New York.

1889. Sherman, Harry M., M.D. Orthopedic Surgeon to the Children's Hospital, and to the Polyclinic, San Francisco. 705 Sutter Street, San Francisco.

*1887. Steele, A. J., M.D. Professor of Orthopedic Surgery and Diseases of the Joints in the St. Louis Post-Graduate School of Medicine; Surgeon to the Augusta Children's Hospital, St. Louis. *Vice-President*, 1890. *President*, 1893. 2825 Washington Avenue, St. Louis.

*1887. Taylor, Henry Ling, M.D. *Vice-President*, 1892. 201 W. Fifty-fourth Street, New York.

1892. Taylor, William J., M.D. Surgeon to St. Agnes's Hospital; Assistant Surgeon to the Orthopedic Hospital and Infirmary for Nervous Diseases. 121 S. Eighteenth Street, Philadelphia.

1892. Thorndike, Augustus, M.D. Surgeon to the Good Samaritan Hospital, and to the Boston Dispensary. 101 Beacon Street, Boston.

1889. Townsend, W. R., M.D. Lecturer on Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York; Orthopedic Surgeon to the New York Infant Asylum. 16 Park Avenue, New York.

*1887. Vance, Ap Morgan, M.D. Surgeon to the Louisville City Hospital, to Sts. Mary and Elizabeth Hospital, and to the Masonic Widows' and Orphans' Home and Infirmary. *Vice-President*, 1891. 229 W. Chestnut Street, Louisville, Ky.

1889. Weigel, Louis A., M.D. Orthopedic Surgeon to the Out-patient Department of Rochester City Hospital. 43 Mortimer Street, Rochester, N. Y.

1890. Whitman, Royal, M.D. Assistant Surgeon to the Out-

patients in the Hospital for Ruptured and Crippled, New York. 126 W. Fifty-ninth Street, New York.

*1887. Willard, DeForest, M.D. Clinical Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital; Consulting Surgeon to the White Cripples' Home, the Colored Cripples' Home, and the Home for Incurables, Philadelphia; Consulting Surgeon to the New Jersey State School for Feeble-minded Children. *President*, 1890. 1601 Walnut Street, Philadelphia.

1891. Wilson, H. Augustus, M.D. Clinical Professor of Orthopedic Surgery in the Jefferson Medical College; Professor of General and Orthopedic Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Orthopedic Surgeon in the Polyclinic Hospital; Clinical Professor of Orthopedic Surgery in the Woman's Medical College of Pennsylvania; Surgeon to St. Mark's Home for Aged and Infirm Women, Philadelphia; Consulting Orthopedic Surgeon to the Kensington Hospital for Women, and to the Philadelphia Lying-in Charity. 1611 Spruce Street, Philadelphia.

1890. Young, James K., M.D. Instructor in Orthopedic Surgery in the University of Pennsylvania; Attending Surgeon to the Orthopedic Department of the University Hospital. 222 S. Sixteenth Street, Philadelphia.

HONORARY MEMBERS.

ELECTED

1891. EDMUND ANDREWS, M.D., 65 Randolph Street, Chicago, Illinois.

1889. HENRY G. DAVIS, M.D., 8 Parlin Street, Everett, Mass.

1892. WILLIAM DETMOLD, M.D., 38 E. Ninth Street, New York.

1889. W. J. LITTLE, M.D., F.R.C.P. Lond., M.R.C.S. Eng., 18 Park Street, Park Lane, W., London, England.

1890. WILLIAM MACEWEN, M.D., LL.D., Professor of Clinical Surgery, and Surgeon to the Glasgow Royal Infirmary; Surgeon to the Royal Hospital for Sick Children. 3 Woodside Crescent, Glasgow, Scotland.

*1889. DAVID PRINCE, M.D.

1891. C. FAYETTE TAYLOR, M.D., 201 W. Fifty-fourth Street, New York.

* Deceased.

CORRESPONDING MEMBERS.

ELECTED

1890. WILLIAM ADAMS, F.R.C.S., Senior Surgeon to the Great Northern Central Hospital, and to the National Hospital for the Paralytic and Epileptic; Consulting Surgeon to the National Orthopedic Hospital. 5 Henrietta Street, Cavendish Square, W., London, England.

1889. Dr. F. BEELY, 126 Potsdamerstrasse, Berlin, Germany.

1892. M. BILHAUT, M.D., 5 Avenue de l'Opéra, Paris, France.

1892. NICHOLAS GRATTAN, F.R.C.S. Edin., Senior Surgeon, County and City of Cork Hospital for Women and Children. 24 South Mall, Cork, Ireland.

1890. Dr. A. HOFFA, Privatdocent der Chirurgie an der Universität Würzburg. Sieboldstrasse 10, Würzburg.

1890. ROBERT JONES, F.R.C.S. Edin., Honorary Surgeon, Royal Southern Hospital. 11 Nelson Street, Great George Square, Liverpool, England.

1890. Dr. E. KERMISSON, Professeur agrégé de la Faculté de Médecine; Chirurgien de l'Hôpital des Enfants Assisté. 27 Quai d'Orsay, Paris, France.

1890. Dr. SIGFRED LEVY, Superintending Surgeon of the Society for the Relief of Crippled and Mutilated Children, Copenhagen. 135 Gothersgade, Copenhagen, Denmark.

1892. ERNEST MUIRHEAD LITTLE, F.R.C.S. Eng., Surgeon to the National Orthopedic Hospital. 40 Seymour Street, Portman Square, London, England.

1889. Prof. Dr. ADOLF LORENZ, Maximilian-platz 7, Vienna, Austria.

1889. HOWARD MARSH, F.R.C.S. Eng., Senior Assistant Surgeon and Lecturer on Surgery, St. Bartholomew's Hospital; Consulting Surgeon, Hospital for Sick Children, and Alexandra Hospital for Hip Disease. 30 Bruton Street, W., London, England.

ELECTED

1890. EDMUND OWEN, M.B., F.R.C.S., Surgeon to, and Joint Lecturer on Surgery at, St. Mary's Hospital; Senior Surgeon to the Hospital for Sick Children, Great Ormond Street. 64 Great Cumberland Place, W., London, England.

1892. PIETRO PANZERI, M.D., Direttore di Istituto dei Rachitici, Milano. Via S. Calimero 31, Milano, Italy.

1892. ROBERT WILLIAM PARKER, M.R.C.S. Eng., Senior Surgeon, East London Hospital for Children; Surgeon, German Hospital, Dalston. 13 Welbeck Street, W., London, England.

1890. PAUL REDARD, M.D., Lauréat de l'Institut; Ancien Chef de Clinique Chirurgicale de la Faculté de Médecine de Paris; Chirurgien du Dispensaire Furtado-Heine. 3 Rue de Turin, Paris, France.

1888. BERNARD ROTH, F.R.C.S. Eng., 29 Queen Anne Street, Cavendish Square, W., London, England.

1890. NOBLE SMITH, F.R.C.S. Edin., L.R.C.P. Lond., M.R.C.S. Eng., L.M.; Surgeon to All Saints' Children's Hospital; Orthopedic Surgeon to British Home for Incurables. 24 Queen Anne Street, Cavendish Square, W., London, England.

*1890. HUGH OWEN THOMAS, M.R.C.S. Eng.

1890. W. J. WALSHAM, F.R.C.S. Eng., M.B. and C.M. Aberdeen; Assistant Surgeon and Surgeon in Charge of Orthopedic Department, and Lecturer on Anatomy, St. Bartholomew's Hospital; Surgeon, Metropolitan Hospital; Consulting Surgeon to Hospital for Hip Diseases, Sevenoaks, and to the Burnley Cottage Hospital. 27 Weymouth Street, Portland Place, W., London, England.

1890. GEORGE ARTHUR WRIGHT, B.A., M.B. Oxon, F.R.C.S.; Senior Assistant Surgeon, Royal Infirmary, Manchester; Surgeon to Children's Hospital, Pendlebury and Manchester. 8a St. John Street, Manchester, England.

* Deceased.

MINUTES

OF THE

SIXTH ANNUAL MEETING

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

Held at New York, September 20, 21, and 22, 1892.

FIRST DAY—*Morning Session.*

The Association met at the New York Academy of Medicine, and was called to order by the President, Dr. Benjamin Lee, at 9.30 o'clock.

The President's Address was then read.

Dr. H. L. Taylor read a paper on "Osteitis Deformans; with a Report of Two Cases."

Discussion by Dr. Park, who exhibited a specimen, and Drs. Whitman and Ryan.

Dr. T. H. Myers read a paper on "Lateral Dislocation at the Knee-joint, due to Local Disease or Paralysis."

Dr. H. Hodgen read a paper on "Adduction Following Fracture of the Neck of the Thigh-bone." Also a "Report on Three Cases of Peripheral Neuritis."

Discussion by Drs. R. H. Sayre and Phelps.

Dr. R. W. Lovett read a paper on "The Classification of Hip Disease."

Discussion by Drs. L. A. Sayre, Phelps, Wilson, Park, Taylor, Moore, and Ryan.

The Association went into Executive Session at 12.15 o'clock.

Dr. Foster moved that, in the absence of the Secretary in attendance upon the Committee on Membership, the reading of the minutes of the last meeting be omitted. Carried.

Dr. Sayre read a telegram from Dr. Hoffa, saying: "With you in spirit."

Dr. Moore invited the Association to hold its next meeting at Minneapolis.

An invitation was presented from Dr. Ransom to hold the next meeting at Richfield Springs.

The Treasurer's report was then read, showing that all of the dues had been paid except those from two members, amounting to $30, and that the Association was indebted to William J. Dornan, printer of the *Transactions*, to the amount of $88.49.

Drs. Lovett and Steele were appointed Auditing Committee.

The Committee on Membership recommended for election to membership the following candidates:

For honorary membership—Dr. William Detmold, of New York.

For corresponding membership—Mr. E. Muirhead Little, of London; Mr. R. W. Parker, of London; Dr. M. Bilhaut, of Paris; Dr. Nicholas Grattan, of Cork; Dr. Pietro Panzeri, of Milan.

For active membership—Dr. J. D. Griffith, of Kansas City; Dr. A. E. Hoadley, of Chicago; Dr. W. J. Taylor, of Philadelphia; Dr. Wallace Blanchard, of Chicago; Dr. J. E. Goldthwaite, of Boston; Dr. Augustus Thorndike, of Boston.

All were duly elected.

The Committee on Nomenclature offered no report. The Committee was continued.

The Committee on Resolutions on the death of Dr. Hugh Owen Thomas reported that suitable resolutions had been drawn and engrossed and forwarded to Mrs. Thomas, from whom acknowledgment had been received. Committee discharged.

The session then adjourned.

Afternoon Session.

The meeting was called to order at 2.30 o'clock.

Dr. B. E. McKenzie read a paper on "Complete Lateral Dislocation of the Hip, with Separation of Both Epiphyses in a Child during Scarlet Fever."

Discussion by Drs. Ketch and R. H. Sayre.

Dr. A. J. Steele read a paper on "Plaster-of-Paris in Orthopedics."

Discussion by Drs. Willard, Vance, Ridlon, Ryan, R. H. Sayre, Weigel, McKenzie, Bradford, Phelps, and Ketch.

Dr. Royal Whitman read a paper on "Observations on the Ultimate Deformities of Pott's Disease; their Modification and Prevention, with especial reference to the Middle Region."

Discussion by Drs. Phelps, McKenzie, R. H. Sayre, Ketch, Wilson, Gillette, Steele, Bradford, Moore, and Griffith.

Dr. E. H. Bradford read a paper on "Lateral Curvature."

Discussion by Drs. Willard, Steele, Ryan, McKenzie, and Ketch.

Dr. A. M. Phelps read a paper and demonstrated, "Experiments Demonstrating the Etiology of the Various Deformities in Hip-Joint Disease."

Discussion by Drs. R. H. Sayre, Myers, and Ketch. Further discussion was postponed, and the Association adjourned.

Second Day—*Morning Session.*

Dr. R. H. Sayre, Vice-President, in the Chair.

Dr. C. C. Foster read an Obituary upon the late Dr. Buckminster Brown.

The discussion upon Dr. Phelps's paper was then continued by Drs. L. A. Sayre, Whitman, Lovett, Judson, Ridlon, Park, Myers, Taylor, Ketch, Bradford, and Steele.

Dr. Samuel Ketch read a paper on "Some Remarks on the Etiology of Club-foot."

Dr. H. A. Wilson read a paper on "At What Age shall the First Treatment for Congenital Club-foot be Initiated."

Dr. Ketch's paper was then discussed by Drs. Park, Phelps, Foster, McKenzie, Wirt, and Steele.

Dr. Phelps presented a patient showing the result of his operation for club-foot.

Dr. Ap Morgan Vance read a paper on "Manual Replacement in the Treatment of Club-foot."

Dr. H. L. Taylor read a paper on "The Treatment of Club-foot by Continuous Leverage."

Dr. Lovett presented two specimens, and read a short paper for Dr. H. L. Burrell on "Congenital Club-foot."

Dr. E. H. Bradford read a paper on "Treatment of Resistant Club-foot."

Dr. B. F. McKenzie read a paper on "Means for the Prevention of Relapse in the Treatment of Club-foot."

Dr. A. J. Steele read a paper on "A Case of Club-foot with Rare Complications."

The Association then adjourned.

Afternoon Session.

Through the courtesy of Dr. Gibney, the Association was called to order in one of the rooms of the Hospital for Ruptured and Crippled.

Dr. A. B. Judson read a paper on "The Weight of the Body in its Relation to the Pathology and Treatment of Club-foot," and presented patients.

Dr. Nicholas Grattan read a paper on "Osteoclasia."

Dr. Grattan, assisted by Dr. Townsend, then exhibited the working of his osteoclast, and fractured the bones of the thighs and legs in several cases of knock-knee and bow-legs in patients provided by Dr. Gibney.

At four o'clock the Association adjourned to accept the invitation of Dr. Phelps to attend his clinic at the Post-Graduate Medical School.

THIRD DAY—*Morning Session.*

The meeting was called to order by Dr. Lee, the President, at 9.15 o'clock.

The Secretary read a paper by Dr. Sigfred Levy, of Copenhagen, "Contribution to the Treatment of Club-foot."

General discussion on Club-foot by Drs. L. A. Sayre, Grattan, Phelps, Moore, Ryan, McKenzie, Wilson, R. H. Sayre, Ketch, Whitman, Judson, and Ridlon.

Dr. Judson then presented a patient wearing his brace.

The discussion was continued by Drs. Griffith, Hodgen, Foster, and Schapps.

Dr. J. E. Moore read a paper on "Six Cases of Excision of the Knee-joint."

Discussion by Drs. Gillette, Schapps, Griffith, Phelps, and Wilson.

Dr. T. H. Myers presented a "New Fixation Splint for the Treatment of Disease at the Elbow-joint."

Dr. J. C. Schapps presented a convenient and cheap bed.

The following papers were read by title:

"The Orthopedic Treatment of Infantile Spinal Paralysis," by Dr. John Ridlon.

"A Report of Two Years' Operative Work in the Hospital for Ruptured and Crippled," by Dr. V. P. Gibney.

"A Study of Some of the Problems in the Mechanical Treatment of Hip-joint Disease," by Dr. N. M. Shaffer.

"The Non-Operative Treatment of Club-foot in Young Infants," by Dr. R. W. Lovett.

"The Treatment of Infantile Club-foot," by Dr. E. G. Brackett.

"The Place of Traction in the Treatment of Club-foot," Dr. N. M. Shaffer.

"The Use of the Wrench in the Treatment of Club-foot," by Mr. Robert Jones and Dr. John Ridlon.

"The Operative Treatment of Club-foot," by Dr. DeForest Willard.

"Analysis of Bone Operations in Club-foot, especially Enucleation of the Astragalus," by Dr. V. P. Gibney.

"An Easy Way to Hold the Operated-on Club-foot in the Corrected Position while the Plaster Splint Sets," by Dr. H. M. Sherman.

"The Necessity for Mechanical Treatment after Operations for Club-foot," by Dr. W. R. Townsend.

"Acute Arthritis in Infants," by Dr. V. P. Gibney.

"Spondylitis of the Second Cervical Vertebra, and its Treatment," by Dr. R. H. Sayre.

Executive Session.

The Auditing Committee reported that the Treasurer's accounts were correct. The report was accepted.

The Report of the Committee on Revision of the Constitution was read, amended, and adopted.

The Association adjourned.

Afternoon Session.

The meeting was called to order at 2.30 o'clock.

The resignation of Dr. W. R. Whitehead was read and accepted.

The Secretary reported the receipt of certain reprints from Dr. Julius Dollinger, of Buda-Pesth.

It was voted to make the Secretary the custodian of all books and papers sent to the Association.

The Secretary presented, in behalf of Dr. Bradford, the following resolutions upon the late Dr. Buckminster Brown, and it was voted that they be spread upon the minutes:

"As our President, in his excellent address, has expressed so well our sense of the value of the work of the late Dr. Buckminster Brown, any remarks from me might seem to the Association simply repetition, yet I cannot refrain from adding a few words of personal tribute to the memory of one who, in my native city, has done so much to advance and elevate the specialty of orthopedic surgery. We all owe to Dr. Brown a great debt for his example of thoroughness and per-

sistency in professional work, and also for the high standard he always maintained. And we should not fail to record our testimonial to the worth of his life and work."

It was voted to tender the thanks of the Association to the New York Academy of Medicine for courtesy in providing a place for our meeting.

It was voted that the papers presented by the candidates for membership who had been elected be referred to the Publication Committee; and that the papers of other candidates be returned to the writers.

The following nominations were made:

For honorary membership—Dr. Lannelongue, of Paris, and Dr. Ollier, of Lyons, by Drs. Willard and Bradford.

For corresponding membership—Dr. Julius Dollinger, of Buda-Pesth, by Drs. Ridlon and R. H. Sayre.

For active membership—Dr. W. O. Plympton, of New York, by Drs. Phelps and Ridlon; Dr. A. B. Hosmer, of Chicago, by Drs. Ridlon and Griffith; Dr. F. S. Coolidge, of Chicago, by Drs. Ridlon and Shaffer; Dr. L. W. Hubbard, of New York, by Drs. Shaffer and Moore.

The following officers were elected:

President—Dr. A. J. Steele.

First Vice-President—Dr. Samuel Ketch.

Second Vice-President—Dr. Arthur J. Gillette.

Secretary—Dr. John Ridlon.

Treasurer—Dr. A. B. Judson.

Dr. N. M. Shaffer, Delegate to the Executive Committee of the Congress of American Physicians and Surgeons.

Dr. Ap Morgan Vance, Alternate.

St. Louis was chosen for the next place of meeting of the Association.

The minutes of the session were read and approved.

The Association adjourned.

List of members present:

Drs. Wallace Blanchard, E. G. Brackett, E. H. Bradford, Dillon Brown, C. C. Foster, V. P. Gibney, A. J. Gillette, J. D. Griffith, Joel E. Goldthwait, H. Hodgen, A. B. Judson, Samuel Ketch, Benjamin Lee, R. W. Lovett, B. E. McKenzie, J. E. Moore, T. Halsted Myers, Roswell Park, A. M. Phelps, John Ridlon, George W. Ryan, L. A. Sayre, R. H. Sayre, J. C. Schapps, N. M. Shaffer, A. J. Steele, H. L. Taylor, W. J. Taylor, W. R. Townsend, Ap M. Vance, L. A. Weigel, R. Whitman, DeF. Willard, H. A. Wilson.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

ARTICLE I.—NAME.

This Society shall be called the "AMERICAN ORTHOPEDIC ASSOCIATION."

ARTICLE II.—OBJECTS.

The purpose of this Association shall be the advancement of orthopedic science and art.

ARTICLE III.—MEMBERSHIP.

SECTION 1. The members shall be graduates of regular medical schools, shall be in good professional standing, and shall be especially interested in Orthopedic Surgery.

SEC. 2. There shall be three classes of members, viz.: Active, Corresponding, and Honorary.

SEC. 3. Candidates for membership shall have been engaged in the practice of medicine for at least five years, and shall have given evidence of satisfactory scientific attainments.

ARTICLE IV.—OFFICERS.

The officers shall consist of a President, a First Vice-President, a Second Vice-President, a Secretary, and a Treasurer, all to be elected annually at the last executive session of a regular meeting.

ARTICLE V.—STANDING COMMITTEES.

There shall be a Committee on Membership, consisting of five members, a Committee on Publication, consisting of three members, and an Executive Committee, consisting of the President, the Secretary, and the Treasurer.

ARTICLE VI.—ELECTIONS.

All elections shall be by ballot; for officers a majority shall elect, for members a four-fifths majority.

ARTICLE VII.—MEETINGS.

The meetings of the Association shall be Regular and Special.

ARTICLE VIII.—FEES.

Active members shall pay an initiation fee of twenty-five dollars, and annual dues of fifteen dollars. Corresponding members shall pay annual dues of five dollars.

ARTICLE IX.—PUBLISHED PROCEEDINGS.

The business proceedings of the Association shall be published annually. The papers and discussions shall be published annually, unless the Association otherwise directs at the close of the regular meeting.

ARTICLE X.—DISCIPLINE.

A three-fourths vote of all members present at a regular meeting shall be necessary for suspension or expulsion of a member.

ARTICLE XI.—THE CONGRESS.

SECTION 1. This Associaion shall hold membership in and meet with the Congress of American Physicians and Surgeons.

SEC. 2. It shall, at the regular meeting held at the time of the Congress, elect a member to represent it on the Executive Committee of the Congress for the ensuing three years, and it shall also elect a second member as an alternate.

ARTICLE XII.—QUORUM.

An actual presence of nine active members at any one meeting shall be necessary for the transaction of business.

ARTICLE XIII.—AMENDMENTS.

Alterations to this Constitution may be made at any regular meeting by a four-fifths vote of all members present; provided that notice of the proposed changes, signed by two active members, shall have been given to all the active members at least one month previous to final action.

BY-LAWS.

ARTICLE I.—MEMBERSHIP.

SECTION 1. Nominations for membership shall be made in writing, signed by the proposer and seconder, accompanied by evidence as to the fitness of the candidate for fellowship, and shall be placed in the hands of the Secretary at least twelve months previous to the time of the regular meeting.

SEC. 2. Candidates for active membership shall, through the Secretary, present a paper to the Association.

SEC. 3. Only those of acknowledged preëminence in orthopedic surgery shall be eligible to honorary membership.

SEC. 4. Foreign residents only shall be eligible to corresponding membership.

SEC. 5. All the scientific privileges of the Association shall be accorded to the honorary and corresponding members.

SEC. 6. Membership shall be forfeited when one ceases to take an active interest in the objects of the Association, or is guilty of an unprofessional act or a public misdemeanor. Action in such cases shall be taken according to Article X. of the Constitution.

SEC. 7. An active member absenting himself for three consecutive meetings, or two years in arrears in payment of dues, may be dropped from the rolls.

SEC. 8. All members in attendance at any meeting shall register in a book provided for the purpose.

ARTICLE II.—OFFICERS AND STANDING COMMITTEES.

SECTION 1. The duties of officers and standing committees shall commence after the adjournment of the meeting at which they are elected or appointed, and shall continue until their successors are duly installed.

SEC. 2. The President shall preside at all meetings, shall deliver an annual address, shall appoint the Committees on Membership and Publication, shall fill any vacancies that may occur from resignation or otherwise.

SEC. 3. The Vice-Presidents shall act in the absence of the President.

SEC. 4. The Secretary shall give due notice of and keep the minutes of all meetings, shall conduct all correspondence, shall notify candidates of their election to membership, and inform members of their appointment on committees, and shall perform such other duties as are assigned to him by the Association.

SEC. 5. The Treasurer shall collect all money due the Association, be the custodian of the same, and pay it out only on warrant signed by the President and Secretary. At the annual meeting he shall make a report of his receipts and expenditures, which, after being duly audited, shall be filed.

SEC. 6. The Membership Committee shall consider the eligibility of all nominees for membership, and shall report its recommendations to the Association.

SEC. 7. The Executive Committee shall make all necessary arrangements for the meetings of the Association, assign the order for scientific work and report the same to all members as early as practicable before the time of the annual meeting; it shall further manage such necessary affairs of the Association as are not already assigned to others.

SEC. 8. The Publication Committee shall attend to the preparation, publication, and distribution of the annual proceedings of the Association; and it shall have discretionary power as to matter for publication in questionable cases.

ARTICLE III.—ELECTIONS.

Election of members shall be held at the first executive session of a regular meeting, and of officers at the last business session.

ARTICLE IV.—MEETINGS.

SECTION 1. The regular meetings shall be held annually during the third week in September of each year, or at such other time and at such place as the Association may elect. If no action should be taken in the matter, the Executive Committee shall decide.

SEC. 2. Special meetings shall be called by the Executive Committee or by the President at the written request of ten active members.

SEC. 3. Every third year the Association shall convene as a part of the Congress of American Physicians and Surgeons.

ARTICLE V.—DUES.

The yearly dues shall be paid to the Treasurer at the time of registration.

ARTICLE VI.—PUBLISHED PROCEEDINGS.

SECTION 1. The Transactions shall be printed as soon after the adjournment of the regular meeting as possible, and distributed to the members, one copy to each except to those in arrears on Association dues.

SEC. 2. Additional copies of the Transactions shall be furnished to members at cost, and to the public at a price to be determined by the Publication Committee.

SEC. 3. Authors desiring reprints of their papers will notify the Publication Committee, who shall already have established rates for reprints with the publishers.

SEC. 4. Papers not in the hands of the Secretary within four weeks after adjournment of the meeting shall be omitted from the Transactions on the unanimous vote of the Publication Committee.

ARTICLE VII.—PAPERS AND DISCUSSIONS.

SECTION 1. Papers read before the Association shall be limited to twenty minutes, unless the time be extended by vote. Discussions shall be limited to five-minute speeches. No member shall speak a second time on the same subject if others desire the floor. The author of the paper shall be privileged to close the debate.

SEC. 2. No papers shall be read that have been previously published. Members publishing their papers aftey they have been presented to the Associatiou shall designate them, "Read before the American Orthopedic Association." Authors desiring their papers illustrated shall furnish the necessary woodcuts.

SEC. 3. Proofs sent to authors should be returned within a fortnight, otherwise the matter will go to press without the author's correction. Marked changes from copy, known as "time work," shall be paid for by the author.

SEC. 4. Transcripts of the discussion shall be furnished the participants for correction, but not for rewriting.

ARTICLE VIII.—EXECUTIVE.

SECTION 1. Two executive sessions shall be held during each regular annual meeting, to-wit: at noon of the first day, and at noon of the last day. The order of business shall be:

1. Reading of unapproved minutes and records.
2. Reports of officers and committees and action thereon.
3. Unfinished business.
4. Election.
5. New business.

The last act before adjournment of the last session shall be the reading of unapproved minutes and action thereon. Urgent business may be transacted at any session by unanimous consent.

SEC. 2. The proceedings of the Association shall be in accordance with parliamentary usage.

ARTICLE IX.—AMENDMENTS.

Proposed Amendments to the By-laws shall be submitted in writing and signed by two active members. Previous notice of the proposed changes shall be given. A three-fourths affirmative vote of all members present at a regular meeting shall be necessary to ratification.

THE PRESIDENT'S ADDRESS.

By BENJAMIN LEE, M.D.,
PHILADELPHIA.

That more time has not been devoted to the preparation of this Address—as much, in fact, as the importance of the occasion demanded and my own intention suggested—is entirely due to the Association itself; the fact being that whenever I set myself to the work of its preparation it appeared desirable for one reason or another to consult a volume of the *Transactions*, whereupon I invariably became so intensely interested in some one of its valuable papers that the moments slipped away unnoticed, and the duty was for the time slighted. In fact, if a *raison d'être* were required of this body, it would only be necessary to point to these four volumes, so full of original thought, sound observation, and practical suggestion. I have said that the occasion is one of importance in the history of this Association. It certainly is one of great interest, for to-day we return to the city of our birth and the city which may properly lay claim to being the mother, also, of the more distinctively American school of Orthopedics. And this is said in no invidious spirit toward those who in other places early wrestled, with steadfast purpose, with the perplexing problems of our art. One such it is my duty to refer to to-day as having laid aside his harness and gone to his reward since our last meeting. While it is true that Dr. Buckminster Brown, owing to his advanced age, coupled with a somewhat feeble organization, had never been able to take an active part in our proceedings, yet his interest in our success, as evinced in his letter to the President at the Boston meeting, in 1889, was deep and sincere, and his name was a tower of strength to a young society like ours, of which he was an original member. As the first distinctively Orthopedic

specialist in this country, it will not be transcending the bounds of good taste if a few words are here devoted to his career.

Dr. Brown came of a race of physicians, and inherited the healing instinct—Dr. John Warren having been his grandfather and Dr. John Ball Brown, of Boston, his father. It has often been the case in our profession that the character of the lifework of its members has been determined by the occurrence of some particular malady in themselves or in their relatives. So it was in this instance. An accident to his little son, which rendered him for eight years an invalid, led Dr. John Ball Brown to a careful study of this then entirely neglected branch of surgery, which resulted in his obtaining so wide a reputation that he found himself compelled to open a private hospital for his orthopedic cases coming from all parts of the country. That the son, thus taught by sore experience of the necessity for scientific management of this class of cases, should have followed in his father's footsteps was only to have been expected.

Born in Boston in 1819, he was graduated from the medical department of Harvard University in 1844, and immediately went to Europe, where he assiduously studied his chosen branch under those great masters, Little, in England; Stromeyer, in Germany, and Guirin, in France, for a period of two years. His modes of treatment rather reflected those of the English surgeons, led by Little—himself, by the way, another conspicuous instance of the influence of a personal disability in deciding the selection of a specialty.

Dr. Brown was naturally well fitted for the management of children, among whom such practice principally lies, by a combination of gentleness with firmness and unusual patience and persistence. His successful treatment of a case of double congenital dislocation of the hips by uninterrupted traction in the horizontal position for a period of two years bears ample evidence to his possession of these qualities. He relied principally on the employment of persistent force by mechanical appliances, which he devised with much ingenuity. He was by no means, however, obstinately opposed to operative interferences, and did much good tenotomy.

In 1861 the trustees of the Samaritan Hospital in Boston opened a ward solely for the treatment of deformities, and placed

him in charge of it. This was, so far as I know, the first instance in this country of a ward in a public hospital so set apart.

Dr. Brown was, first, a generously educated man; secondly, a well-instructed physician; and thirdly, a thoroughly equipped specialist. This constitutes the ideal of what the specialist should be. His zeal in the practice of his art brought him a deservedly large practice, and secured for him a reputation not confined to the limits of his native land. His death took place at Auburndale, Mass., December 24, 1891, at the age of seventy-two years.

Having thus paid a tribute, however inadequate, to the memory of a deceased member whose virtues we may well emulate, allow me to call your attention for a few moments to some points in reference to The Inflammation of Cartilage.

The Mutter lectures of the College of Physicians of Philadelphia for the spring of 1882 were delivered by Dr. E. O. Shakespeare, of that city, on the "Histology of Inflammation." In this course he avoided the examination of that process in tissues in which the influence of the bloodvessels is prominent, in order to escape, as far as might be, the confusion which the presence of the emigrant white corpuscles throws over the changes going on in the inflamed tissue. The tissues which he made the subject of his experiments and observations were, accordingly, the cornea, the tunica interna of the bloodvessels, cartilage and serous membranes. The histology of all of these tissues presents, as you well know, close resemblances. With reference to hyaline cartilage, such as covers the ends of the bones in diarthodial joints, he maintained that the intercellular matrix in which the cells are imbedded is not, as usually considered, homogeneous or structureless, but that it is indeed distinctly fibrous in its constitution. The reason why this structure is overlooked is twofold. First, because of the extremely close and tenacious character of the cement substance which binds the fibres together, and, secondly, because the index of refraction of this substance is so nearly identical with that of the fibres as to make it a matter of great difficulty to distinguish the outlines of the latter. These fibres are arranged in bundles, which near the surface run parallel to the same, but as deeper layers are reached gradually become oblique, until finally they may assume a direction at right angles to the surface. In this process of transition there

is a domain where the arrangement may be called reticulate. In the interspaces thus formed are found the cartilage cells, the cement-like substance already mentioned, and minute radicles of the lymphatic system. It is in or through these latter that calcareous deposits take place in that form of degeneration. For the cartilage cell Dr. Shakespeare claimed that it is "almost a perfect analogue of the connective tissue corpuscle found in ordinary fibrous tissues as to its shape, its formation, and the morphological changes which it may undergo." On the one hand, he finds it closely analogous to the fat vesicle, and, on the other, to the connective tissue corpuscle to which has been attributed the power of the creation of new lymph spaces, lymph capillaries, and lymph cells. The cell development appears to be indigenous, cell forming within cell, and the disintegrated outer cell walls being compressed into the endothelial cell plates which line the lymph cavities. Hence, it may happen that the centre of a lymph space may be occupied by a lymph corpuscle which may remain quiescent or dormant without tendency to evolution.

The lymph spaces communicate with each other, with the lymphatics of the perichondrium and with those of the medullary spaces in the lines of ossification. These channels of communication are, however, so minute that an entire lymph corpuscle cannot pass through them.

Now with regard to inflammatory processes in this tissue: The absence of direct vascular supply and the minuteness of the lymph channels naturally make any changes resulting from injury very slow of development. The changes observed by Dr. Shakespeare occurred in the following order: The superficial cells lose their fat, their nuclei first divide, and then the cell itself, developing daughter cells. If this development of daughter cells is too rapid to allow of their becoming encapsulated they begin to feed upon the adjacent matrix; the bundles of fibres are thus loosened and separated until their free extremities may float in the synovia of the joint, and cartilage cells, with their offspring, are set free in the cavity. In cases where the proliferation is excessively rapid the matrix is completely devoured, the lymph spaces fuse together, and masses of embryonal tissue are formed by the young cells. Certain patches of the cartilage may thus be entirely eroded or changed into con-

nective tissue, especially in situations farthest remote from vascular supply, since the cells must look entirely to the surrounding tissues for their nourishment. In positions, on the other hand, in which bloodvessels are near at hand, the activity of the cells may lead them to build up new adventitious tissue formations, producing hypertrophies or ecchondroses.

The processes, both of destruction and repair, therefore, are carried on through the agency of the cells proper to the tissue. "In-wandering cells are in the earlier stages out of the question." When considerable changes have been wrought by the inflammatory process, lymph cells or white blood corpuscles from outside may find their way in, but the fixed cells must be allowed to possess "an exceedingly active and potent agency," both in the destructive and in the reparatory processess constituting inflammation in this tissue.

In No. 6 of the *Berliner klinische Wochenschrift* for the present year is a contribution by Prof. Paul Grawitz on "The Structure of Areolar Tissue and Its Significance with Regard to the Histology of the Inflammatory Processes," in which he announces the discovery of what he calls "Schlummer Zellen," slumbering or dormant cells, in normal areolar tissue, and claims for them an extremely important rôle in pathological changes.

He says: "For a long series of years this fibrous substance was known without a recognition of the fact of the existence of cellular elements between its fibres. The numerous investigations into inflammation in areolar tissue and the cornea, and into the processes of repair in various organs, have for decades been prosecuted on the unanimous presumption that we must choose between the proliferation of the fixed cells of the areolar tissue and the introduction of colorless blood corpuscles, since any other source for the origin of cells was unknown, and was therefore straightway excluded.

"In to-day's lecture," he proceeds, "I propose to demonstrate, that, in addition to the fission of the fixed areolar tissue cells and the emigration of colorless blood corpuscles, a possibility exists for the origin of areolar tissue cells, which has been up to the present time overlooked, although it is a very prolific and, in many chronic inflammations, perhaps the only source of cell development, namely, the formation of cells out of the intercellular substance. In exam-

ining the so-called moulded areolar tissue as it occurs in the tendons I have observed in the neighborhood of wounds, just where the tendon was relaxed by incision, a series of new areolar tissue cells of a distinct character, which gradually became visible between the normal visible tendon cells in such a manner that the intervening broad, homogeneous bundles of fibres appeared thus to be cleft into constantly narrowing smaller fibres."

Dr. Shakespeare, commenting on this supposed original discovery of Grawitz in an article also published in the *Berliner klinische Wochenschrift*, No. 26, of the present year, says: "According to this author, there exist in the areolar tissue of tendons, in addition to the already recognized visible so-called fixed areolar tissue cells, three usually invisible fixed elemental forms, which slumber, as it were in the so-called moulded tendon; and these slumbering or dormant cells may awake under the influence of an irritant, and then play a conspicuous rôle not only in all inflammatory and hypertrophic processes, but also in all those conditions of the tissue which we have until now conceived of as simple atrophy. The author also asserts an entirely analogous arrangement for other areolar tissues."

Dr. Shakespeare is therefore justified in considering that his own observations of ten years ago have received a convincing and almost complete confirmation from this trustworthy observer.

I have been led to present this subject for the consideration of the Association from a careful perusal of the admirable monograph on "Diseases of the Hip-joint," by one of our own members, to which has, deservedly, been awarded the Fiske Prize, and which has appeared during the past year. It is with sincere pleasure that I congratulate both the author and the Association on the publication of a work which cannot but reflect honor upon both. Systematic in its arrangement, just in its treatment of subjects requiring considerable delicacy of handling, it bears evidence of thoughtful study, close observation, and wide experience. Its carefully prepared statistics place the distinctively American treatment of hip disease on a vantage-ground far above the positions occupied by the methods pursued in other countries, and on that account alone the Association is to be congratulated.

In treating of the etiology of hip disease the author fairly says: "Formerly the writers on the etiology of hip disease could be

classified into two schools—those who believed in a constitutional cause for the affection and those who would find the cause in a local trauma. Later years have tended to bring forward those who believe that the disease is oftenest the result of both causes." The whole drift of his argument, however, is in favor of the presence of the bacillus tuberculosis as the invariable cause of the disease, and he probably represents the consensus of opinion at the present time. Having been myself one of the earliest to accept the doctrine of the communicability of phthisis, and of the bacillus as the medium of communication, I am so sensible of the seductiveness of the germ theory that I feel we should be extremely cautious about accepting it in any given affection without overwhelming evidence in its favor.

Let us for a moment consider the facts as to the actual proven presence of the bacillus in either the inflamed or broken-down tissue or in the pus in cases of chronic inflammation of joints, as presented by those who support the theory of the invariably tuberculous origin of such affections. It is acknowledged that the bacilli are usually present in such very small numbers that only the most experienced microscopist can ever hope to find them at all. When, in a given case, only two bacilli are discovered in twenty sections by a most experienced observer, it leaves a little room for doubt as to whether they were really bacilli or some adventitious particles that had taken the stain. In many instances not a single bacillus can be found after the most diligent search. As having a collateral bearing upon this point, I may mention that I have been informed by my colleague in the Philadelphia Polyclinic, Dr. B. Alexander Randall, that in cases of otorrhœa accompanying tuberculosis pulmonum, not once in ten times can the bacillus tuberculosis be discovered in the discharge, and then only with extreme rarity.

Secondly: Carefully collated statistics by different observers show that it is a rare thing for the children of those who have had chronic articular disease to be similarly affected.

Thirdly: The proportion of cases which can be traced to distinctly tuberculous parents is less than one-half as stated by most observers. With the wide diffusion of phthisis at the present time, it is probable that any disease whatever would show as large a percentage of suspicious parentage.

In consideration of the researches and facts above presented, I would venture to propose the following

SUMMARY.

First: The old macroscopic descriptive definition of inflammation as the condition evidenced by the existence of *calor, dolor, tumor, rubor,* has long been abandoned.

Second: With this abandonment has fallen the theory that vascularity in a part or tissue is an essential to the origin of inflammation.

Third: The non-vascular tissues contain within themselves the elements necessary to the establishment of inflammatory processes.

Fourth: Among the non-vascular tissues hyaline cartilage is preëminently well supplied with such elements.

Fifth: It is therefore unnecessary to presuppose the entrance of foreign elements into cartilage in order to the production of inflammation.

Sixth: Like the inflammatory process in all other tissues, the character and progress of inflammation in cartilage is greatly modified by the condition of vitality of the individual in whom it may occur.

Seventh: It is often impossible to find a single bacillus in the products of chronic articular inflammation.

Eighth: When found, after exhaustive search, their numbers are ridiculously disproportionate to the extent of the pathological changes supposed to be due to their action.

Ninth: The self-limiting character of chronic articular inflammation under appropriate conditions is the reverse of what we observe in the tuberculous process elsewhere.

As our old friend Captain Cuttle was wont to remark, "The bearings of this observation lies in the application on it." I lay these propositions before you, believing them to be correct and defensible, and leave you each to make the application for himself as his habits of thought and experience incline him.

OSTEITIS DEFORMANS (PAGET).

With Report of Two Cases.

By HENRY LING TAYLOR, M.D.,
NEW YORK.

Osteitis deformans (Paget) is a chronic inflammatory disease of advanced life, affecting the long bones, spine, cranium, and pelvis, and characterized by pain, hypertrophy, and softening, so that the bones which sustain weight, as the leg bones and spine, become curved. The bones of the face, hands, and feet are rarely affected, the joints are not involved, and suppuration does not occur.

As pictured by Sir James Paget in his original paper: "On a Form of Chronic Inflammation of the Bones," published in the *Lancet*, November 18, 1876, and in the Medico-Chirurgical *Transactions* of 1877, the disease stands forth sharply differentiated from other affections of the bones, and claiming clinical and pathological recognition as a distinct morbid process. Similar cases had been described by others, and the name had been used by Czerny[1] to describe an entirely different affection, but Sir James Paget's graphic, masterly, and original study was the first to awaken interest, and to him more than to any other we owe our knowledge of the subject. Other able observers in England, notably Lunn, MacKenzie, and Hutchinson, have since studied this affection, described specimens, and reported cases. A few cases have been reported in France; scarcely any in Germany or Italy. An important series of papers in the *Illustrated Medical News*, 1889, and in the *Medical Press and Circular* for 1890, have confirmed Paget's observations of the clinical history, symptomatology, and pathology

[1] Wiener med. Wochenschrift, 1873, p. 896.

of the affection. Thibierge was able to collect 42 published cases to add to his own, which he published with an admirable *résumé* of the subject in the *Archiv. gén. de Méd.*, January, 1890.

In America, McPhedran and McKenzie in Toronto and Gibney in New York have reported cases of this affection; others reported by Lippincott, Daly, Ellinwood, and Wightman cannot be accepted as instances of Paget's disease.

Of the 43 cases analyzed by Thibierge, 21 were men and 22 women. The onset was, with very few exceptions, after the age of forty; the average age of 32 cases was fifty-one years. One case has been reported which began at thirty (Case XXI.), and one at twenty-eight (Case XIX.); a few began as late as sixty-five.

The disease does not seem to be hereditary, or, except in rare instances, to run in families. In one instance two brothers (Cases XXVIII. and XXXI.) were affected; in another, a female (Case XXII.), the father and brother (Case XXXIV.) had possibly suffered.

Mr. Thomas Bryant followed one of Paget's original cases till death at the age of seventy. He had no brothers and but two sisters; these were beginning to show signs of the disease at the time of his death.

No connection is traceable between this disease and syphilis, tuberculosis, gout, or rheumatism. It is probably a general disease, with its principal lesions in the osseous system, and depends on some anomaly of nutrition of undetermined origin (Thibierge).

Of 8 of Paget's cases traced to the end, 5 died of cancer or sarcoma; and of 23 cases observed by him, 4 became blind.

The onset is insidious and the progress exceedingly slow. The first symptom is often a dull or severe aching in the affected bones, which may persist throughout, but in some cases pain is absent, and the gradual enlargement of the head, often necessitating a larger hat,[1] or increasing deformity of the spine, tibia, or femur may be the only symptom noticed. The bones most frequently

[1] In Paget's first case the hat measure increased from 22½ inches in 1844 to 27¼ inches in 1876, but the head retained its natural shape. It may appear square or somewhat bossed. Even when the skull is enlarged, pain in the head has not been observed.

affected are the tibiæ, femora, clavicles, spine, and vault of the skull in the order named. The pelvis is not rarely broadened and thickened. There is a tendency to symmetry in the lesions, but there may be marked deviations. The disease may rarely be confined to a single bone, as the femur or tibia, and early in its course it is often confined to but one or two. The pathological process is inflammatory rather than degenerative, and of extreme chronicity. The bone structure shows a mixture of rarefying osteitis, with the Haversian canals large and irregular, sometimes notched at their edges; and of formative osteitis with certain Haversian canals narrowed, and lamellæ of recent formation. As is usual in mixed

Fig. 1.

Section through the skull from a case of osteitis deformans.
(From Mansell Moullin.)

Fig. 2.

Femur from case of osteitis deformans.
(From Humphrey.)

lesions, the systems of lamellæ which surround the Haversian canals lack the regular arrangement of the normal tissue, and are turned in different directions. The vessels and Haversian canals are not dilated. It is probable that the marrow is more or less affected. (Thibierge.)

The process results in a gradual enlargement of the diseased

bones, so that the skull may attain to three or four times its normal thickness, with obliteration of the diploë, and the long bones add materially to their length and perhaps double their circumference. The enlargement is fairly even and uniform throughout the affected bone, though the surface may be slightly bossed. Coincidently with this enlargement the bone becomes softer, and bends to the superincumbent weight. The femora and tibia especially, if affected, become markedly bowed outward and forward, so that the knees are separated by several inches. The trochanters rise above Nélaton's line by reason of the diminished angle between the neck and the shaft of the femur. In well-marked cases the thighs are everted, and the hips and knees somewhat flexed. The joint surfaces are not affected unless by some accidental complication, though motion may be somewhat limited by the nature of the deformity, and possibly by ligamentous rigidity or thickening.

The spinal deformity is quite characteristic. There is commonly a bowing forward of the spine, and this is usually more prominent in the upper half, while the lumbar region loses its concavity and becomes straight. The head is carried far forward and droops toward the chest. The shoulders are round and stooping, the chest sunken toward the pelvis, the costal breathing shallow, and the belly pendulous. The spine is nearly rigid, and may be the seat of severe pain. Instead of this antero-posterior curve there may be a lateral curvature of the spine, developed late in life. The general appearance, attitude, and gait of the patient are strikingly modified by these changes. The height may be diminished by several inches; the trunk and legs seem short, while the arms retain their natural size, and the hands hang near the patient's knees. The head is large and carried forward by the bent neck and spine, and this with the bent and separated knees and "slow and awkward" gait give the patient a dwarfish or simian aspect exceedingly striking and readily recognized.

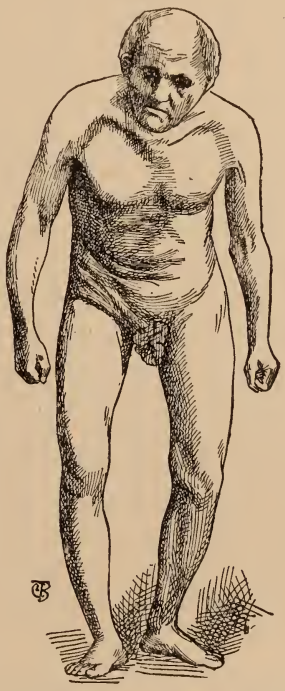
The bone does not appear to be brittle, and fractures are rare; when they do occur they unite without difficulty. It will be observed that the general appearance is somewhat suggestive of extreme senility, or of paralysis agitans, where the deformities of the skull and long bones are, of course, lacking. The attitude and spinal deformity resemble those of the extreme form of arthritis

deformans, known as "spondylitis deformans," but the joint lesions in the latter affection easily distinguish it. As the bones of the face, hands, and feet only are affected in acromegaly, it is easily differentiated from osteitis deformans.

Fig. 3.

Osteitis deformans. (From Hutchinson.)

Fig. 4.



Characteristic attitude in osteitis deformans. (From Lunn.)

If the characteristics and site of the bony enlargements and deformities, the age of the patients, the fact that the joints are exempt, and that there is no tendency to suppuration are remembered, the differential diagnosis should not present serious difficulties.

The progress of the disease is exceedingly slow, and with little apparent effect on the health of the patients, who often live to an advanced age and usually succumb to some complicating affection. The therapeusis of this malady is unsatisfactory; nothing has been found to arrest or favorably modify its progress. I have regretted

that in the first case to be related I did not try the effect of antero-posterior support to the spine by means of a properly constructed leverage apparatus. It has seemed to me that, in cases where the backache was severe, such treatment offered some prospect of relief, and I intend to try it, should a suitable opportunity present itself.

In England, the only country where it appears to have been well studied, the disease does not seem to be very rare, and it is not unlikely that, as its characteristics become more familiar to the profession, many cases may be reported in other countries.

In August, 1891, a gentleman of sixty, whose very peculiar gait and attitude at once attracted my notice, called to consult me in regard to a distressing backache, from which he had suffered some ten years. His back was much bowed, especially in its upper half, and his neck was bent, so that the head, which was very large, was carried forward and at the same time dropped toward the chest. His figure was dwarfish and his height did not appear to exceed five feet, as he stood in his habitual attitude with the legs a little flexed at the hips and knees. The latter were somewhat separated and the legs appeared short, but the arms seemed very long in proportion to the length of the body. Though my patient's intelligence was evidently unusually keen, there was something ape-like in his figure and in his awkward, half-shuffling gait, which produced an impression different from anything I had ever seen.

My patient was a lawyer, born in England, but for many years a resident of Canada, a hard worker and of regular habits. He had most of his life enjoyed good health, but for ten years had suffered with severe pain across the lower part of the back, shooting out to each side, but not down the legs nor over the abdomen; it was especially apt to come on after rising from the sitting posture, and on the whole had been getting worse. During the same time his body had become bent so that he could no longer stand erect, and five or six years previously he had noticed that the right femur was bowed forward and outward, and this had lately increased; there had been no pain in the legs. He had, he said, lost at least an inch in height in the previous twelve or eighteen months. He instinctively avoided walking, but riding in a carriage did not hurt him.

His family physician, Dr. J. B. Hall, of Toronto, stated that he

had been noted for his large head, but could not say whether it had increased in size in the last few years, and I omitted to question my patient on this point.

His digestion had been good and his bowels regular. His water had frequently been examined, and a trace of albumin had occasionally been found, but it was usually normal in quality and amount. He did not think he was short of breath.

Examination showed the radials thickened and atheromatous, and a systolic murmur at the base of the heart. The back was much bent in the cervical and dorsal regions, so that the chin could be separated but a short distance from the chest. The lumbar region of the spine had lost its natural concavity, and was straight or slightly convex; the whole spine was much stiffer than normal. The pelvis was large and too little inclined. Both knees and hips were a little bent, the trochanters reached somewhat above Nélaton's line, and extension and rotation at the hips were somewhat restricted, but there was no muscular spasm and no indication of joint trouble. When the feet were placed together the knees were separated by an interval of three inches, owing to the very marked bowing of the right femur. This bowing extended throughout the length of the shaft in a forward and outward direction, and was more pronounced at its upper end. The femur was larger and longer than normal. The right thigh was also considerably everted. There was no other bone deformity of the legs, but the left femur was probably enlarged.

R. A., $31\frac{5}{8}$; L. A., $32\frac{3}{8}$. In the first measurement the tape just touched the right knee; in the second it is deflected inward. Circumference of the thigh seven inches above the patella: right, $16\frac{1}{4}$; left, $16\frac{1}{2}$.

Trochanter to external malleolus: right side, $31\frac{1}{2}$; left side, $31\frac{1}{4}$. Trochanter to knee: right, 17; left, 16.

Knee to external malleolus: right, $15\frac{1}{8}$; left, $15\frac{3}{8}$.

The apparent discrepancy is due to the deformity, and possibly to anomalies of the tibiæ.

The case was so typical that I at once made the diagnosis of osteitis deformans, in which Dr. Hall concurred.

The resemblance between the femoral deformity in this patient and that in the case of a lady of sixty-nine, who had been under my

observation since 1888, was so striking that a review of the latter case convinced me that her deformity must be attributed to the same cause. This lady came in 1888 to consult me about her left hip, which had been injured three years previously by a fall on the floor. There were eversion and complete disability at once, but her surgeons found no true crepitus and no shortening. There was excruciating pain behind the hip, down the thigh, and at the inner side and front of the knee. She was kept in bed with weight extension ten weeks, and it was nine months before she could, with difficulty, go about on crutches. Three years after the accident she still depended on crutches, and suffered excruciating pain, for which she sought relief. It is not necessary to go into the further history of the left hip, except to say that she was in time relieved of severe pain, and enabled to walk readily with a cane.[1]

Fig. 5.

Writer's second case of osteitis deformans.

At the first examination my attention was attracted by a very marked and peculiar deformity of the *right* femur, which, on questioning, she said she had first noticed a year after the accident, and which she was positive did not exist before it. The deformity

consisted in a very marked bowing forward and outward, especially at the upper part (Fig. 5).

The circumference of the thigh at the crotch was 18 inches on the right side, 16 on the left.

R. A. was $31\frac{1}{4}$; L. A., $30\frac{5}{8}$. From the knee to the internal malleolus was: on the right side, $13\frac{5}{8}$; on the left, $13\frac{1}{4}$. From the knee to the external malleolus was: on the right side, $14\frac{5}{8}$; on the left, $14\frac{3}{8}$.

Trochanter to knee: on the right side, $16\frac{1}{2}$; on the left, $16\frac{1}{4}$.

There was also a moderate rotary lateral curvature of the spine, with the dorsal convexity to the left, which she was equally sure did not exist before the accident. She had had and was having more or less pain in the right (excurvated) thigh; and a few weeks later she said that the pain in the right thigh was worse than that in the left. She never had had pain in the right thigh until she began to walk after the accident; she had had a great deal of pain in the back since the accident. At the time she began to walk she had been obliged to shorten her skirts nearly an inch.

I examined this patient again in the fall of 1891, and found that the spine and right femur were decidedly more bent. Both trochanters were an inch above Nélaton's line, and the shaft of the right femur was very distinctly enlarged throughout. The curving was such that the right popliteal space was fully three inches from the flat couch on which she was lying, and there was a space of two and one-half inches between the knees when the feet were in contact. The left leg was entirely straight. She had fallen twice within a year without known cause, the first time the previous spring, when she had broken both bones of the left forearm near the wrist. These had united with a little deformity, and she then had a good deal of pain in the arm.

Her height was fifty-eight inches without shoes, which was considerably less than formerly. Her pelvis was large for her body, but no enlargement of the head could be made out. She stood pretty erect for one of her age. Measurements showed some diminution in the distance from the iliac spine to the malleolus on either side, but an increase in the distance from the trochanter to the knee and from the knee to the malleoli.

The typical excessive deformity of the right femur with pain and

thickening, and with a lateral curvature coming on late in life, convinces me that this is also a case of osteitis deformans.

The literature of Paget's disease of the bones, taken from Thibierge's paper, with a few additions, is appended. The numbers refer to cases described in the papers:

A. *Typical Observations of Osteitis Deformans.*

. *Wrany:* Präger Vierteljahresschrift, 1867, Bd. i. p. 79.
Wilks: Trans. Path. Soc., 1868-69, xx. p. 273.
3. *Bourceret:* Gaz. des Hôp., May 4, 1876.
4, 5, 6, 2, 7. *Sir James Paget:* Lancet, Nov. 18, 1876, p. 715; Med.-Chir. Trans, 1877, lx. p. 37.
4. *Annandale:* Edinb. Med. Journ., 1877, xxii. p. 639.
8. *Bryant:* Guy's Hosp. Rep., 1877, xxii. p. 337.
9. *Cayley:* Trans. Path. Soc., 1877-78. xxix. p. 172.
10. *Howse:* Trans. Path. Soc., 1877-73, xxix. p. 182.
11. *Treves:* Trans. Path. Soc., 1880-81, xxxii. p. 167.
12. *Symonds:* Guy's Hosp. Rep., 1881, xxv. p. 99.
3. *Rathery* and *Leloir:* Revue de Méd., 1881, p 738.
13, 14, 15, 16, 17, 18, 19. *Sir James Paget:* Med.-Chir. Trans., 1882, lxv. p. 225.
20. *Huchard* and *Binet:* Bull. Soc. Clin., Paris, 1882.
21. *H. Morris:* Trans. Path. Soc., 1882-83, xxxiv. p. 188.
22. *Pick:* Lancet, 1883, ii. p. 1125.
23. *Rogier:* Thèse de Paris, 1884.
24. *Silcock:* Trans. Path. Soc., 1884-85, xxxvi. p. 383.
5, 18. *Stephen Paget:* Trans. Path. Soc., 1884-85, xxxvi. p. 382.
25. *Lunn:* St. Thomas' Hosp. Rep., 1884, xiii. p. 43.
26. *Pozzi:* French Surgical Congress, 1885.
27, 28, 29, 30, 31. *Lunn:* Trans. Clin. Soc., 1885, xviii. p. 273.
3. *Guinon:* Bull. Soc. Anatom., 1885, lx. p. 344.
32. *S. Mackenzie:* Trans. Clin. Soc., 1885, xviii. p. 331.
33. *Martel* (of St. Malo): Gaz. Méd. de Paris, 1886, p. 257.
34. *Robinson:* Trans. Path. Soc., 1886-87, xxxviii. p. 262.
35. *Richard:* Thèse de Paris, July 16, 1887.
36. *Lyon:* In Richard's paper.
37. *Clutton:* Trans. Path. Soc., 1887-88, xxxix. p. 259.
38. *Goodhart:* Trans. Path. Soc., 1887-88, xxxix. p. 262.
39. *Lunn:* Trans. Path. Soc., 1887-88, xxxix. p. 265.
40. *Southam:* Med. Chronicle, Manchester, 1888, viii. p. 125.
34. *S. Mackenzie:* Illustrated Med. News, 1888, i. p. 2.
41. *Hutchinson:* Illustrated Med. News, 1889, ii. p. 169.
32. *St. Mackenzie:* Illustrated Med. News, 1889, ii. p. 186.
14. *Robinson:* Illustrated Med. News, 1889, ii. p. 189.
27, 28, 29, 30, 42. *Lunn:* Illustrated Med. News, 1889, ii. pp. 182, 265; Med. Press and Circular, 1890, ci. p. 541.
43. *Thibierge:* Archiv. gén. de Méd., January, 1890.
34, 32. *S. Mackenzie:* Med. Press and Circular, 1890, ci. pp. 569, 595.
44. *McPhedran:* Med. News, Phila., 1885, xlvi. p. 617.
45. *Gibney:* Med. Record, New York, 1890, xxxvii. p. 452.
46 *McKenzie:* Canadian Practitioner, July 16, 1891, p. 337.

B. *Incomplete Observations.*

Balsam: Medical Society of London (Lancet, 1882, ii. p. 892).
Barlow: Medico-Chirurgical Society (Brit. Med. Journ., 1883, i. p. 1178).
Bishop: Manchester Central Med. Soc. (Lancet, 1887, ii. p. 189).

Clay: Midland Med. Soc. (Brit. Med. Journ., 1889, i. p. 657).
Lloyd: Midland Med. Soc. (Brit. Med. Journ., 1889, i. p. 1118).
Edmunds: Illustrated Med. News, 1889, ii. p. 180.
Barling: Illustrated Med. News, 1889, ii. p. 292.
Humphry: Illustrated Med. News, 1889, ii. p. 187; Med. Press and Circular, 1890, ci. pp. 625, 650.
Paget: Med. Press and Circular, 1890, ci. p. 515.

C. *Doubtful Observations.*

Rullier: Bull. Faculté de Méd., Paris, 1809, ii. p. 94.
Goodhart: Trans. Path. Soc., 1877-78, xxix. p. 175 (two cases).
Lediard: Trans. Clin. Soc , 1883, xvi. 235.
Ollier: In Pozzi's paper, French Surgical Congress, 1885 (two cases).
D'Arcy-Power: Trans. Path. Soc., 1885-86, xxxvii. p. 269 (two cases).
Lunn: Trans. Path. Soc., 1886-87, xxxviii. p. 266.
Hutchinson: Med. Press and Circular, 1890, pp. 461, 487.
Edmunds: Med. Press and Circular, 1890, ci. p. 516.

D. *Observations incorrectly cited as of Osteitis Deformans.*

Lippincott: Amer. Journ. of Med. Sci., January, 1876, p. 113. (Traumatic osteomyelitis.)
Howse; Trans. Path. Soc., 1877-78, xxix. p. 184. (Rheumatic osteitis.)
Daly: Med. Record, 1880, i. p. 225. (Rheumatism.)
Bowlby: Trans. Path. Soc., 1882-83, xxxiv. p. 192; Illustrated Med. News, 1889, ii. p. 188 Med. Press and Circular, 1890, ci. p. 649. (Chronic osteomylitis with necrosis.)
Ellinwood: Western Lancet, San Francisco, 1883, p. 159. (Acromegaly.)
Wightman: Archives of Medicine, New York, 1883, x. p. 146. (Diagnosis uncertain.)
Elliott: Lancet, 1888, i. p. 170. (Hyperostosis, Hagner's type.)

DISCUSSION.

Dr. Roswell Park, of Buffalo, showed a specimen of this disease, which he had removed from a dissecting-room subject, apparently about fifty-five years of age. His attention was not attracted to the hip-joint by any outward evidence of the disease, the specimen being discovered in the course of dissection. He had seen an elderly man who was bent at right-angles by a process which the speaker took to be the same as that described in the paper.

Dr. Royal Whitman, of New York, said that the specimen exhibited was a good illustration of arthritis deformans, but was quite different from the original specimen, in London, of osteitis deformans. In the specimen here the joint alone is involved, whereas in osteitis deformans the entire bone is thickened and softened.

Dr. L. A. Sayre had in his museum specimens of arthritis deformans exactly similar to the specimen under discussion.

Dr. Taylor, in closing the discussion, said he agreed with the previous speakers in considering Dr. Park's specimen an excellent example of arthritis deformans, a disease which he believed had no pathological or clinical relation to osteitis deformans. In the latter involvement of the joint may exist as a complication, but is not an essential feature of the process, which is a slow inflammatory hypertrophy of the bone. Some apparent exceptions had been reported, but these he believed were capable of explanation on the ground of their being incidental complications or mistakes in diagnosis. So far as he knew, only three genuine cases of osteitis deformans were to be found in American literature—two in Toronto and one reported by Dr. Gibney in New York.

LATERAL DISLOCATION AT THE KNEE-JOINT DUE TO TUBERCULAR DISEASE OR PARALYSIS, WITH ESPECIAL REFERENCE TO MECHANICAL TREATMENT.

By T. HALSTED MYERS, M.D.,
NEW YORK CITY.

About a year and a half ago, a girl, seven years of age, was admitted to my service at St. Luke's Hospital with tubercular osteitis of the knee. The joint was boggy and swollen. The limb flexed at an angle of 135°, and only 10° of motion allowed. The tibia was rotated outward 30°, and partially subluxated backward and outward. The joint was very sensitive and reflex muscular spasm marked.

In this case I applied traction in the two directions—forward, inward, and downward against the head of the tibia, and in the long axis of the tibia—without attempting to overcome the flexion. The method which I used was so simple and so generally applicable that I can recommend it in many such cases where ankylosis has not occurred, and where there is no bony hypertrophy to prevent replacement. But first let us consider for a moment the deformity itself.

I have lately, through the kindness of Dr. Shaffer, been able to study the cases of knee-joint disease, excluding those due to rheumatism and to punctured wounds, which applied for treatment at the New York Orthopedic Dispensary before 1891. Among these 486 cases subluxations were noted 57 times. In all of these the deformity was, as in my case, posterior displacement with outward rotation, and occasionally also outward dislocation. There was frequently also knock-knee, more or less marked.

In cases of poliomyelitis anterior involving the thigh and leg

we find a very similar deformity developed. In these, however, the rotation seems more marked than in the osteitic cases, and the flexion less so.

The similarity of these deformities naturally leads us to suspect a similar cause for both. In paralytic cases the muscles acting on the head of the fibula through the fascia lata are the least involved, and in almost all cases, however severe, there remains some power in the tensor vaginæ femoris, and even more constantly in some of the glutei. These muscles are powerful outward rotators when the knee is flexed. Structural changes occur in paralyzed muscles as early as the twenty-third day (Herter: *Journal Nerv. and Mental Dis.*, April, 1889), and these changes in the hamstring muscles tend to make the flexion of the leg permanent. The position of the limb, lying as it does on its outer side, also tends to increase the outward luxation and rotation.

In osteitis, on the other hand, reflex muscular spasm of the posterior muscles produces backward dislocation. The biceps, especially its short head, which arises from the middle line of the femur and runs outward and downward to the head of the fibula, is well placed to cause outward rotation. All the inner hamstring muscles, on the other hand, except the semi-membranosus are attached below the prominent internal tuberosity of the tibia, much nearer the longitudinal axis of the limb, and are therefore less powerful rotators. Sayre considers the action of the biceps more powerful than that of these four muscles combined (*Orthopedic Surgery*, p. 202).

I was at first inclined to believe that cases showing great bone-destruction would constitute the majority of these subluxations, but I found on the contrary that in only one-third of them was the presence of abscess noted, although this very generally accompanies extensive caries or necrosis. I also found that the location of the focus of disease was of no special significance: the same deformity occurring whether it was in the femur, in the tibia, or in the joint. Of course, destruction of a condyle would facilitate rotation in a corresponding direction, as the tibial spine could not then lock the joint. On the other hand, in paralytic cases there is no bone-destruction, yet the rotation is even more marked than in the former cases.

The ligamentous changes are, however, of great importance in both classes of cases. In nearly all osteitic cases there is a history of synovitis which would relax or destroy these structures, while in the paralytic cases they share in the general atrophy. When the knee is inflamed it assumes a position of flexion, and in paralytic cases flexion follows the contraction of the less affected muscles.

The internal crucial ligament is tense in flexion, and is, as I have determined by dissections made through the kindness of Dr. Forbes, the chief obstacle to subluxation of the tibia backward. Even after all the other ligaments and muscles of the joint were divided, it was impossible to produce this deformity. Rotation I expected, from the position of this ligament, would also be largely controlled by it, and this I found to be true to a certain degree, since its attachment to the tibia is a little to the inside of the axis of rotation of the joint, and the inner tuberosity is therefore prevented from slipping backward more than the outer one is. The spine of the tibia also played an important rôle, in locking the joint by impinging on the adjacent condyle as rotation was made inward or outward. This action was lost, however, if the bones were not firmly held together.

The obstacles to reduction of this deformity are the contracted or contractured muscles, the shortened ligaments and fasciæ, and the bone-hypertrophies in the parts relieved from normal pressure. Bone-growth is most rapid in the early years (Pye: *Lancet*, July and August, 1890), and in regard to this point, in these 486 cases the onset of the disease occurred in the first, second, third, and fourth years in 34, 74, 73, and 53 cases respectively. In a few of these cases hypertrophies were felt in the inter-trochlear groove, and in several the patella was adherent to the femoral condyle, and usually displaced somewhat outward. The conditions present in those cases which went on to operation, I have not been able to ascertain. The prognosis depends, therefore, chiefly on the age of the patient, and the duration of the deformity.

The dangers of reduction are liability to rekindle quiescent disease, or exaggerate that present. Again, in both paralytic and osteitic cases, we may, unless the head of the tibia is pressed well forward, simply straighten the limb, and leave a more marked posterior luxation than ever; or we may reduce the flexion and

posterior luxation, and yet leave rotation and outward luxation. Separation of the tibial epiphysis is produced sometimes even when the hamstrings and the fascia lata have been divided, probably owing to contraction of the deep-lying ligaments.

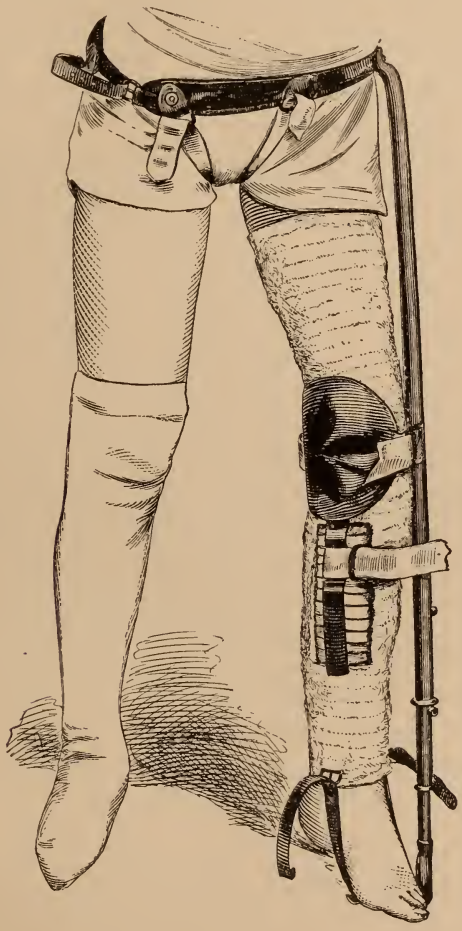
The treatment of subluxations that I had used up to this time, and which I preferred theoretically to any other, was carried out by Dr. Shaffer's extension knee-brace, which produces traction away from the joint, both above and below, by adhesive plasters, and exerts at the same time a pressure on the head of the tibia downward and forward. Traction can be applied exactly in the line of deformity. This brace is used, of course, with crutches, but here is a great disadvantage. It is extremely difficult to keep adult private patients who are most intelligent from testing the soundness of such a limb to see if they can walk without their crutches. It is many times harder to keep the children of this class of people from going without their crutches at times, and in dispensary practice I think it is impossible to prevent this. Foster's, Ridlon's, and Stillman's braces are open to the same objection, as is also that of Sayre. In the latter the anterior traction is made by means of a bandage passed behind the head of the tibia, and then in front of the lateral bars.

All these splints aim to produce traction and immobilization, and depend upon crutches or recumbency to avoid the direct traumatism of percussion in walking. On the other hand, the Thomas's knee-splint insures this protection, but does not afford traction except when the flexion is being reduced. It reduces this deformity in a way calculated to crowd the joint-surfaces together, and after the deformity is corrected the joint is not completely immobilized.

This raises the question at once as to the necessity of avoiding percussion, and this point I hope to follow out more fully at a future time. From what I have seen, however, I believe that joints, though immobilized and treated by traction, do better when always protected from direct pressure than those not so protected; that is to say, traction and immobilization are not enough.

I therefore attempted to combine Dr. Shaffer's knee-splint with a perineal crutch, and succeeded in getting a theoretically perfect instrument, but it was too complicated and expensive for dispensary

work. None of these braces correct pure lateral deformity, however, and though this deformity is infrequent as compared with the posterior displacement, still it occurs frequently enough to bring it to the notice of us all. Little (*Deformities*, 1853, p. 78) used in



these cases a stationary apparatus to which the patient was bound. The pressure was applied in the proper directions by screws.

I decided to try the following simple method in my case: Adhesive plasters were first applied to the leg; then a padded webbing band was passed around the upper part of the tibia and fibula, the

ends being carried to the front and inner side of the limb; the leg and thigh were now incased in plaster-of-Paris; then a long window was cut in the splint over the upper half of the tibia diametrically opposite the deformity, so that the leg bones might be drawn forward, inward, and downward, without interference from the splint. A spring was placed across this window, and the webbing fastened over it, thus securing traction in the correct line. Traction was also made by weight and pulley, or by a perineal crutch in the longitudinal direction.

Improvement in flexion was rapid; the lateral deformity yielded more slowly. When the flexion was overcome, the patient was allowed to walk about wearing the perineal crutch. In this case I did not use longitudinal traction after this, as the disease was quiescent and the joint not sensitive. The lateral deformity yielded steadily, and the limb is now straight, and has been for a long time. There was no œdema or swelling of the limb caused by the band, as I had feared there might be.

In a second case the history has been almost identical. The lateral deformity was marked; the posterior, moderate. There was flexion between 155° and 145° only. The disease had existed six years, and the joint was considerably swollen. The splint was applied as before, but instead of using a spring I exerted the desired amount of traction on the tibial strap and then secured the ends by reversing them over the edges of the window and buckling them together behind the leg. After a trial, however, I found this method less effective than the spring. In this case traction was maintained longitudinally after the patient began walking by applying adhesive straps to the thigh also and reversing the end of these plasters and the ends of the leg plasters over the top and bottom of the splint, according to the suggestion made to this society by Dr. Taylor two years ago. After six months' treatment, during which time the boy was not confined to bed at all, the limb was perfectly straight and the lateral deformities overcome.

In osteitis the reflex muscular spasm must always be considered in the treatment, and it will continue after the limb is straight. This necessitates extension, immobilization, and protection from concussion. In infantile paralysis, on the other hand, after correction of the deformity we have only to prevent its recurrence;

tenotomy and immediate correction are not objectionable, as there is no danger of increasing a local disease, and the sooner this is done the less will be the hypertrophic changes in the parts relieved from their normal pressure. In some cases, both of osteitis and paralysis, these changes have become so marked as to counter-indicate mechanical treatment.

The principles guiding the treatment of these cases are well known, but sometimes the practical difficulties of applying them are so great as to be prohibitory. For this reason I offer this simple method of overcoming this complex deformity, feeling that it will be effective in most cases where there is no bony ankylosis nor marked hypertrophic bone-growth anteriorly.

DISCUSSION.

Dr. R. H. Sayre said that in using his father's knee splint he had practised for some time using a perineal crutch instead of an axillary one for children, and with good result. He had endeavored to accomplish the same thing as the author did with traction by a spring, by passing a bandage underneath the head of the tibia, and also by bandages around the thigh, above and below the middle joint of the apparatus and around the side bars, making traction in whatever direction seemed to most favor the restoration of the bones to a straight position. As an instance of the obstacle sometimes offered by the spine of the tibia to reduction, he cited a case of excision in which he had found, on cutting down to the joint, that the reason he had been unable to reduce the deformity was that the spine of the tibia had become greatly hypertrophied and projected at least one inch between the condyles, presenting a firm barrier to reposition. When this was removed there was no difficulty in overcoming the deformity.

Dr. A. M. Phelps, of New York, had excised many of these joints and had found almost invariably that the posterior aspect of the external condyle was cut away by pressure of the biceps tendon. In such cases, where the patella is adherent and the lateral liga-

ments short, it is very difficult to reduce the deformity even under ether, and hence, he had usually resorted to excision, which gave a good stiff limb. In the last two years he had excised seven or eight cases which had been previously treated by traction appliances. In some of them the limbs were quite straight, yet even in these they were nearly useless limbs. Undoubtedly many of them would yield good results with the ordinary traction splints, but he was in favor of excision in these cases, especially among the poor.

Dr. C. C. Foster, of Cambridge, said that many found difficulty in reducing the deformity because they forgot that the knee-joint is not a simple hinge, and that it must travel around the end of the femur. He disapproved of using a spring for traction when there is serious inflammation of a joint, and he thought that when traction is made by means of adhesive plasters attached to the skin within a few inches of a joint, there is much less real extension obtained than is generally supposed.

REPORT OF THREE CASES OF UNUSUAL JOINT LESION.

By B. E. McKENZIE, M.D.,
TORONTO.

I. Spontaneous Dislocation of the Hip.

November 20, 1890. Mrs. J. T. R., aged twenty-one years; had one child, two months ago. Her mother once lay for some time confined to bed because of some nervous trouble. August 16th, at about midnight, Dr. Mennie was called to see the patient, and found her sitting upon the side of the bed unable to get in. Complained of great pain down the back of the right thigh and leg and about the hip. Had not been lame previously, except that there was a noticeable limp on the 16th. Had for some time previously complained of pain in the shoulders, elbows, knees, and fingers, and some of the joints, especially those of the hand, were slightly swollen. Dr. Mennie had been treating her for rheumatism. No accident had occurred. She came upstairs herself and undressed to retire. The pain came on when she sat down on the side of the bed. Dr. Mennie found her very nervous, and could not get her into bed until he had administered chloroform. From the first, the right femur assumed a position of flexion and adduction. In a few days she had to have a pillow under the knee. The leg became more flexed and more adducted during the weeks that followed. Lay in bed two months; complained much of pain in the groin over the adductors and over the great trochanter. She habitually sat in bed during this time, bringing the right knee up nearly to the chin, and having her hands clasped over the knee. During the month that had just elapsed previous to this consultation she had been out of bed at times, moving about by the aid of crutches. Upon examination, I found the right foot drawn up and its inner surface lying against the inner and anterior surfaces of the left tibia, and the right

heel about seven inches above the left. The femur was held at an angle of 145°, and adducted 45°, so that the opening of the vulva was placed against the inner side of the thigh, and the femoral crease was covered by an eczema over a space two inches by six inches; the femur rotated inward. Gave chloroform. The thigh was fully flexed, and upon movement the trochanter could be well outlined not much higher up than that on the left side, and the head of the femur could be distinctly felt behind and a little above its normal position. There was no swelling of the parts about the joint. It was evidently a case of dislocation of the head of the femur upon the dorsum ilii.

The knee being fully flexed, also the femur, abduction was made, rotation outward, and complete extension, the left hand being kept behind the joint as a fulcrum. Some structure, apparently fibrous, was felt to give way, and the leg was brought down into nearly normal position. The obstacle to complete extension seemed to be the contraction of the flexors and adductors and the shortened inter-muscular septum lying inward from the tensor vaginæ femoris. The limb was fixed in this position by a long side-splint, and the next day a Thomas posterior hip-splint was applied with a view to retaining the limb in this position. There was no elevation of temperature, and no swelling or reaction because of the reduction of the dislocation. The following are the measurements made with care at this time:

Right calf	8¼ inches.
Left "	8¾ "
Right knee	11¼ "
Left "	11¼ "
Right thigh (2 inches above patella)	10¼ "
Left " " " "	10¾ "
Right " (6 inches above patella)	13¼ "
Left " " " "	13¼ "
From right anterior superior spine to right internal malleolus	30 "
" left " " " " left " "	30½ "
" umbilicus to right internal maleolus	32½ "
" " " left " "	33 "

Splint was removed early in January, 1891; hip-joint apparently ankylosed; has remained constantly in bed; suffers no pain.

June, 1891. Mrs. R. lame, but walking without aid; general health much improved.

September 8, 1892. Patient has had another child, now nine months old, a large healthy boy. She is much improved in health, being much fleshier and of good color; walks lame; is worse at some times than at others, depending upon conditions of the weather. Sometimes for a few days is almost confined to a couch, having pain at the front of the joint over the great trochanter, and sometimes as far as the knee and even to the ankle. On examination, I find complete ankylosis, no adduction, no shortening, no atrophy.

Nearly all cases of spontaneous dislocation have been observed at the hip.[1] This case, no doubt, occurred through muscular action and through pressure of the patient's hands pushing the head of the femur toward the cotyloid notch as the limb was held strongly flexed. The ankylosis which now exists in the joint probably points to the rheumatism as an important causative factor.

II. Complete Lateral Dislocation of the Knee.

M. M., aged fifty years, farmer, about five feet nine inches in height, one hundred and seventy pounds in weight; always a rugged, healthy, active man. In March, 1891, while working in the woods hauling logs with his team, a long and rather slender log to which his team was hitched became wedged between two trees, one of which was in contact with the butt of the log, the other on the opposite side about the middle, while the team was hitched to the smaller end, drawing so as to bend the log, thus increasing its pressure against both of the trees; at the smaller end the log had a diameter of about six inches. While the team was drawing forcibly the chain about the log broke, and the latter springing back struck the leg. Upon examination there was found a complete lateral dislocation, the femur inward, the tibia outward. There was about three inches of shortening. There was no abrasion or bruising on the surface to indicate what part of the leg had been struck. Reduction was easily accomplished by traction and manipulation, and the leg was placed on a MacIntyre splint at an angle of about 160°. There was soon a large amount of swelling and considerable ecchymosis, especially on the outer side. There was not much shock. No great amount of pain was complained of. Pul-

[1] Stimson on Dislocations, 1888, p. 463.

sation could be found in the dorsalis pedis a few hours after the accident. The leg was kept carefully at rest for about three months, there being considerable tenderness about the joint. There was no sloughing; no abnormal sensations remained in the leg. There was considerable shortening in the calf muscles, producing a moderate degree of talipes equinus. This has been satisfactorily overcome in later months by exercises employed for stretching the posterior group of muscles. There is now very slight lameness and the limb can be fully extended and flexed to 90°.

The number of cases of this dislocation in which there was a complete separation of the ends of the tibia and femur is very small.[1] As in other cases the reduction was easily effected, the reaction slight and recovery good.

III. Separation of Femoral Epiphyses at Both Hips During Scarlet Fever.

January 15, 1891. C. C., male, aged four years; was ill in spring of 1890 with scarlet fever; had always been a healthy boy, active and perfectly formed Had a long illness, made a tedious recovery; had several abscesses, one in front of the ear, one over the larynx, and one over the great trochanter on the left side. These all seemed to be superficial. He became greatly emaciated and digestion was very poor. Was carried out of doors each day, and in autumn had sufficiently improved to be able to walk, in so doing showing a very awkward mode of movement. It was described by his father as a waddling gait. His appearance and movement were characteristic of double congenital hip dislocation. On drawing the limbs down and shoving up again, they move through a distance of about an inch and a half, and there was felt a cartilaginous grating in each limb, most marked in the left. No tenderness or swelling; general health excellent; has no pain; sleeps well.

Diagnosis: Separation and probably absorption of the epiphyses. I recommended fixation and extension by the use of a Thomas double hip-splint. This treatment was not adopted, and the boy was taken to an institution in the United States where a complicated appliance was employed.

[1] Stimson on Dislocations, 1882, p. 467 et seq.

January, 1892. Examined the boy again, and found that mechanical appliances of various kinds had been employed, with a view to correcting the lordosis and holding the femora in place. There is, however, little or no improvement. When the weight rests upon the feet the trochanters are carried far above the normal line. In any case of this kind I think it exceedingly doubtful whether an ambulatory appliance can be devised which will retain the femora in the right place in reference to the acetabula.

DISCUSSION.

Dr. S. Ketch, of New York, thought that after the reduction of the dislocation there must have been greater changes than one would expect from simple rheumatism, and ankylosis pointed rather to a chronic osteitis than to an affection of fibrous tissue.

Dr. R. H. Sayre had only seen one case of spontaneous dislocation of the hip, and it is generally considered that it is impossible for this dislocation to occur as the result of muscular action. He had already exhibited before the Society of the Alumni of Bellevue Hospital a young girl who had a dislocation of the bone on to the the dorsum of the ilium, as was subsequently proved by operation. She had a congenital malformation of the urethra, which made it necessary for her to keep the thighs constantly adducted in order to check the dribbling of urine. After excluding fracture, or other trauma, he had come to the conclusion that this persistent adduction had resulted in the production of the dislocation.

Dr. McKenzie, in closing the discussion, said that in the summer of 1890 the patient had been confined, and that six weeks later she was attended by a physician and treated for rheumatism. When he first saw her, three months later, the dislocation was readily reduced, and the splint was applied for six weeks, and was then removed under protest. The marked improvement in her general health had led him to exclude bone disease, and, as she still continues to suffer from rheumatic pains, he thought it was fair to assume that rheumatism was the cause of the condition which he found.

OBSERVATIONS ON THE ULTIMATE DEFORMITIES OF POTT'S DISEASE: THEIR MODIFICATION AND PREVENTION, WITH SPECIAL REFERENCE TO THE MIDDLE REGION OF THE SPINE.

By ROYAL WHITMAN, M.D.,
NEW YORK.

The neglected cases at our clinics and the results of similar affections in animals show that, although unaided, Nature may overcome disease and finally adapt herself to adverse conditions, she is helpless to directly prevent deformity. This weakness affords the opportunity for the orthopedic surgeon, and although the diseases he treats are often directly or by their complications dangerous to life, his ability and success are estimated not by the survival of the patient, but by the degree of final deformity. The immediate treatment of disease must thus be modified by a foreknowledge of its effects, by the environment of the patient, and the intelligence of those who have charge of him. The balancing of the various factors that affect the life and future usefulness of the patient, the necessity of care and watchfulness through many years, and of moral and physical training to attain the best result, make this specialty one of the most difficult as well as one of the broadest and most humane of all the divisions of medicine.

The most important study, then, for the orthopedic surgeon is that of ultimate results—that we may learn of the direct danger to life from disease, and its complications, and thus come to a clearer understanding of its proper treatment; to apprehend on the one hand the significance of symptoms that demand operative interference, and to avoid, on the other, the needless sacrifice of joints by operations which disregard the final well-being of the patient.

By this study we learn that ultimate deformity, often attained after many years, is remarkably constant in its appearance, varying with the severity and duration of the disease and the function of the joint involved, but dependent on natural laws in its development, the voluntary and involuntary effort to relieve pain, the effect of irritation, tension, or pressure on the growth of bone, the force of gravity, and the final compensation for the change in attitude of the affected part.

If we accept the proposition that unchecked deformity may imply unchecked disease, that Nature not only cannot prevent direct deformity, but by its compensations in the growing child may induce secondary distortions, sometimes as exaggerated and important as the original, it follows that we should at all times endeavor to combat deformity, primary or secondary, which observation has shown to be the ultimate effect of the disease we are treating. Pott's disease differs somewhat from similar affections of other joints, in that early diagnosis is essential for absolute prevention of deformity, as the characteristic deformity resulting from destruction of bone cannot be directly remedied. On the other hand, the number of component joints of the spine that may take on the functions of those destroyed, and the position of the part covered by clothing, render this, when properly treated, a favorable region for an ultimately good result from an æsthetic point of view.

The ultimate deformities of Pott's disease vary with the region involved. When the two extremities of the elastic column are affected, the opportunity, so to speak, for deformity is small; it is opposed by the physiologic curves of the spine, and is easily compensated for. In the cervical region favorable factors in treatment are the small size and compact tissue of the vertebræ; the pain and early deformity caused by muscular spasm, which calls attention to the affection; the ease with which the head may be supported in proper position, and the amenability of the patient to bed-treatment, which so quickly relieves the symptoms; in the lower dorsal and in the lumbar region, the accuracy with which the spine may be supported and the attitude of the patient, the body being thrown backward, so that the weight falls behind the weakened point.

In disease of the middle dorsal region all these favorable factors

are wanting. The affection is often subacute in character, and is not recognized in the early stage. The deformity is favored by the normal posterior curvature of the spine and by the attitude of the patient. The disease is aggravated by the movement of the ribs in respiration, and by the movements of the arms suspended opposite the weakened point; and, finally, the compensatory changes in the spine and thorax exaggerate the deformity not only in the presence of active disease, but throughout the growing period.

To illustrate: In middle dorsal disease the attitude is often a drooping, sagging one; the inclination of the body is forward; the kyphosis lies between the shoulder-blades; above this point the spine bends sharply forward until the region of the head is reached; below the projection is a marked lordosis; the upper part of the chest is sunken and flattened, so that the shoulders appear elevated; the sternum is prominent, and the ribs compressed from side to side, changing the shape of the thoracic cavity from an elliptical to a cylindrical form. These characteristic changes, well marked in disease of long standing, are indicated even in cases of slight deformity. The kyphosis exaggerates the lordosis and the lordosis exaggerates the kyphosis. The weakened spine causes deformity of the chest, and the deformity of the chest, with the resulting displacement of the thoracic and abdominal viscera, not only increases the tendency to further deformity, but reacts on the general condition of the patient.

The first impression of the ultimate effect of the deformity of middle dorsal disease is misleading, as the attitude of the patient appears to be one of abnormal erectness, of elevation and squareness of the shoulders. This elevation is apparent only, and due to the sinking of the head and shortening of the neck. As the deformity increases the scapulæ are separated from one another, and the shoulders are relatively and actually displaced forward, so that a straight line may be passed between the heads of the humeri without touching the chest. Ultimate compensation for deformity relates to the proper position of the head. Normally the weight-line of the body passes through the mastoid process, the centre of the hip-joint, to the medio-tarsal joint of the foot.

Practically, this position is finally attained in disease of any region of the spine, and is attained by compensation for deformity

in the line of least resistance, which, in the region under consideration, is below the seat of disease. While the lower spine assumes the position of extreme lordosis, the upper part practically continues the angle of the kyphosis. In other words, there is no true compensation in the sense of antagonizing deformity in the upper segment. Thus, in untreated cases the trunk may become almost triangular in appearance, the head sunken into the base between the shoulders, midway from the projecting sternum in front and the kyphosis behind. We may assume, I think, that if the inferior lordosis or compensation in the region of least resistance were impossible, Nature, in the attempt to bring the head into the normal line, would under favorable circumstances produce a straightening and elevation of the superior portion, as it does in disease of the lower region, when compensation below is impossible.

The local deformity of Pott's disease is of slight importance compared with the effect on the spine as a whole. If, for example, the destruction of the body of a vertebra is represented by a V-shaped posterior projection, the actual deformity is measured by the length of its arms or its influence on the unaffected vertebræ. This influence does not depend entirely on the extent or severity of the disease, but rather on the situation, and, although we cannot separate the cause and effect in treatment, the prevention of unnecessary deformity in the region under consideration overshadows the importance of the disease, as the ultimate weakness and disability of the patient depends upon the deformity, the degree of which is limited, not by Nature, as in the upper and lower segments of the spine, but by the art of the surgeon. The importance of freeing the spine from the influence of local deformity is emphasized by the fact that active disease is usually accompanied by abscess and inflammation of the surrounding soft parts, so that contraction, with final consolidation in the deformed position, may be considered one of the factors in unnecessary deformity. Our efforts should be directed to straightening the entire spine above and below, and thus to limit the kyphosis to the actual extent of disease.

We may now consider how this object may be attained. It may be attained, I believe, by directing our attention to effects as well as to causes. If compensation takes place in the region of least resistance by an exaggeration of the lordosis, this lordosis must be

prevented. If the shoulders are displaced forward, overhanging the sunken chest, they must be drawn back to their full limit. If the chest becomes prominent and compressed laterally, this tendency must be restrained. If the head is thrust forward and downward, it must be supported, the chin elevated, and the weight thrown backward.

As I wish to call attention particularly to backward traction on the shoulders and restraint of unnecessary motion of the arms, I may explain why I believe this to be an important element in the treatment of disease of the middle region of the spine. In the normal spine, backward traction on the shoulders obliterates the physiologic posterior curvature in the dorsal region, while direct forward motion of the arms increases it. Backward traction makes

Fig. 1.

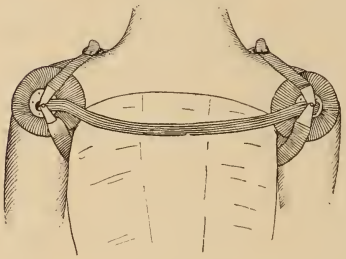
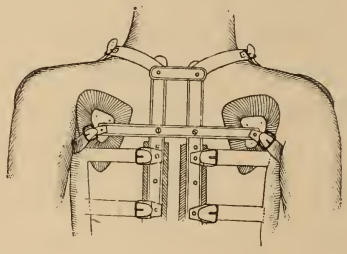


Fig. 2.



the chest appear more prominent, but actually diminishes its antero-posterior diameter. Forward movements of the arms act in the opposite way. Thus, backward action and restraint directly oppose the attitude and approximation to the deformity that is characteristic of the disease under consideration. In addition, it limits voluntary flexion of the spine to the cervical region, while, with the arms free, motion is possible to a much lower point. Backward traction through the clavicles and pectoral muscles tends to raise the upper portion of the chest, and through the serrati muscles to counteract the lateral compression. It assures an increased leverage at the seat of deformity, fixes the spine, and tends to limit the movements of the ribs.

If, in addition, the chin is elevated and supported, we may very effectually oppose the gradual sinking of the upper spine by assuring an habitual attitude of military erectness. The apparatus that

I have used has already been described in the *Transactions* of the last meeting. Muscular spasm having been overcome by rest, with extension if necessary, a Taylor back-brace is fitted, the bars being perfectly straight in the lumbar region, assuming that the deformity is moderate in degree. At the fifth dorsal vertebra a cross-bar is placed, terminating in two triangular rubber pads which cover the scapulæ. The brace is then applied, with the aim of drawing the lumbar spine firmly against the back bars. On the front, two

F:G. 3.[1]

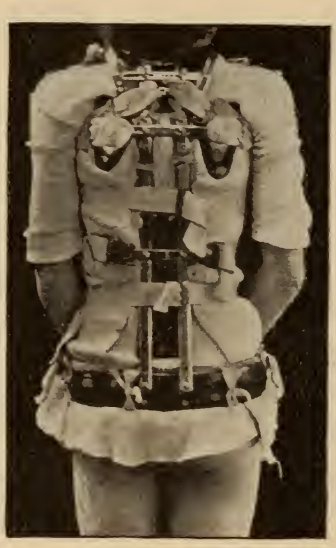
FIG. 4.

saucer-shaped rubber plates cover the prominence of the shoulders, resting on the deltoid muscles, and the heads of the humeri are connected by an unyielding steel bar that passes across the front of the chest. The shoulders are then drawn back to their full limit and the shoulder-plates firmly attached to the neck bars of the brace and the scapular pads behind. While the necessary motion of the arms is not to any extent restricted, the direct forward-reaching movements which tend to increase deformity are entirely prevented.

[1] The photographs illustrate the application of the brace with the chin support and the attitude attained in a case of well-marked deformity of the middle dorsal region. The patient was presented at the meeting of the Association.

The straightening of the spine and backward traction on the shoulders bring into relief the forward inclination of the neck and head. On this account I have used a light elliptical steel bar, passing from the brace behind, beneath the chin, with the object of supporting it, and tilting the head backward, to bring the weight of the occipital region into a more favorable position. If this attitude of military erectness can be maintained, the kyphosis is limited to the seat of actual disease, the spine is straightened above and below,

Fig. 5.



and is freed from the deforming influence of the angular projection. In the growing child we may hope by thus changing the pressure to modify the shape of the unaffected vertebræ so as to conform with the changed conditions, and prevent the gradual increase of general deformity that, in disease of this region of the spine, almost always takes place after apparent cure.

I am on this account very much inclined to doubt the statistics of cure of disease in a certain number of months or years, at least, in the sense of attainment of the best possible result. On the contrary, I believe that in many instances supervision is necessary throughout the entire period of growth, or until observation has

shown that the kyphosis in no way influences the unaffected spine, as shown by the habitual attitude of the patient.

The treatment here outlined may be considered proper in disease of the region between the fifth and tenth dorsal vertebræ—in other words, when the centre of the kyphosis is at or below the middle of the scapulæ.

A consideration of ultimate deformity shows that such treatment would be manifestly improper in, for example, disease of the third dorsal, when the final result to be expected is an excavation between the shoulder-blades, a flattening of the chest and backward displacement of the shoulders, a deformity quite the opposite of that under consideration. Nor would it be indicated in the lower region, when the inclination of the body is backward, and the lordosis tends to limit the disease; but when the upper portion of the body droops forward and the indications of final deformity are as have been described, I believe that we can by this means directly influence the course of the disease and its results.

As you are aware, there is another type of disease of the middle dorsal region, more often observed in young children, accompanied by evident weakness, in which the head hangs backward or on one shoulder, and the body is supported by the arms; there is the characteristic grunting respiration, the pain and other symptoms that accompany the acute phases of the disease, indicating the necessity for complete relief of the superincumbent weight by rest on the back.

If, however, middle dorsal disease may act as the cause of deformity through many years of growth, it is evident that bed-treatment can be but a temporary measure, indicated here, as in disease of other joints, by the symptoms.

While absolute rest may not be considered advisable or cannot be enforced, there is a modified form that may be of much importance—that by lengthening the time passed in bed and by periods of rest on the back during the day. The benefits of open air and exercise may thus be assured without injury to the patient, for, as is well known, in weakness or vulnerability of any joint, it is not the temporary activity that is harmful, but long-continued and unrelieved strain.

When the disease is no longer active, massage of the back and

abdomen may be employed. The brace may be removed at night and gradually made lighter and more suggestive in character.

I hope that it has been made clear that these remarks apply only to a certain region of the spine, to a selected class of cases, and particularly to a type of disease uncomplicated by great deformity or by acute symptoms; no attempt has been made to consider details of treatment or the management of complications on which ultimate success depends. I shall again call your attention to the principles of treatment by which I believe ultimate and unnecessary deformity may be overcome and avoided: The recognition of the fact that middle dorsal disease, in the sense of producing deformity, may be a factor that operates throughout the growing period; that deformity, direct and compensatory, should be combated from first to last; that attention should be directed to the entire spine and head, in the endeavor to attain a military erectness of attitude that can only be permanently assured by freeing the spine from the influence of local deformity and by developmental changes in the unaffected vertebræ; that backward traction of the shoulders and restraint of unnecessary movements of the arms are important factors in success, and that chin-supports are indicated whenever the inclination of the spine above the seat of disease is forward rather than backward.

These observations are presented as a contribution to the study of the treatment of disease in a region that, if neglected, produces greatest deformity, and in which the least satisfactory results are attained in those who have had the benefit of early and persistent care.

DISCUSSION.

Dr. R. H. Sayre said that he had on a previous occasion expressed himself as considering the holding back of the shoulders in disease of this part of the spine as an essential feature of the treatment. He had seen this child before the application of the chin-piece, and he was free to say that she is now very much straighter than at that time. He was not yet quite decided as to whether this apparatus gave sufficient control of the neck, and he

was inclined to think that in some cases it would be necessary to confine the head in a much more irksome position.

Dr. S. Ketch referred to a paper which he had read at the last meeting of the Association, in which he had emphasized the difficulty experienced in preventing an increase of the deformity in disease of the spine in the dorsal region. He could also bear witness to the apparent improvement which had taken place in the case since last winter. For a long time he had been of the opinion that where the disease existed as low as the tenth dorsal vertebra a chin-piece should be used, and Dr. Whitman had improved on this by adding a shoulder-piece. The speaker added that he had just learned from one of the gentlemen present that he had not had any increase in the deformity in a single one of his cases. This was a cause for congratulation, for, personally, he did not expect to attain such a result when there was disease of the spine between the third and the tenth vertebræ inclusive.

Dr. A. M. Phelps said that he was the gentleman alluded to by the last speaker. In his opinion, there was no need for an increase of the deformity. It would certainly occur if the Taylor brace were used, but with plaster-of-Paris properly applied, and a jury-mast properly inserted, deformity will not increase except in children under three years of age. For children under four years of age the plaster-of-Paris portable bed, or a Sayre's wire cuirass, was the only proper apparatus. Treatment by the simple application of rags and plaster-of-Paris is not sufficient, but the patient must be properly suspended, and the jury-mast inserted, with the head well thrown back.

Dr. H. A. Wilson was very much surprised to see a case of disease in the mid-dorsal region in which the deformity had not increased, and he thought it hardly possible that it would not occur at least after the removal of the brace. The element which produces deformity is the superincumbent weight of the head, and this has been apparently ignored in the apparatus under discussion. He used an apparatus having a support for the head, and pads placed in front of the shoulders, so as to press them back.

Dr. A. J. Gillette asked if Dr. Whitman thought he could effect an improvement in the deformity itself, for, at present, he

had under his care a case in which he believed this had been accomplished.

Dr. A. J. Steele considered recumbency the important point in the treatment, and that "the stretcher-splint" which he had devised would be found of value. With its use the general health should not deteriorate, even after months of recumbency. By maintaining this position, the superincumbent weight of the head is removed from the diseased spine, and the affected parts are at the same time thoroughly immobilized.

Dr. Wilson agreed with the last speaker, that recumbency was essential to the cure of the deformity, and he believed that in effect recumbency could be secured by the apparatus which he had already recommended.

Dr. Ketch thought one important feature in the production of the deformity had not yet been mentioned, namely, the respiratory movements.

Dr. B. F. McKenzie said that he had made use of what is known as "the croquet-hoop apparatus," in conjunction with a jacket of leather, raw-hide, or plaster. A steel arch is embedded in the corset, and then brought over each shoulder and down the back. This apparatus, which was first described in the *British Medical Journal* many years ago, gives much better support than does the jury-mast.

Dr. E. H. Bradford said that he had hoped the Association had gotten beyond the point where any one apparatus was alone considered capable of curing a disease. We all know that in caries of the spine in the dorsal region there is likely to be an increase in the deformity, and we are also pretty well agreed that this can be prevented with care, and that, too, whether resort was had to recumbency, plaster-of-Paris, the jury-mast, or other apparatus. If his own child were affected, he thought he would prefer to use an apparatus; but, at the same time, he was willing to admit that it would require a vast deal of watching and attention. Dr. Whitman had accomplished a great feat when he had succeeded in preventing an increase in the deformity during a period of one and a half years, and this result he attributed more to Dr. Whitman's careful atten-

tion to the details of treatment than to the special apparatus which he had employed.

Dr. J. E. Moore thought the weak point in Dr. Whitman's brace consisted in no provision being made for preventing decided lordosis at the lower part of the spine.

Dr. Sayre thought that any apparatus which did not control the shoulders by making pressure directly on the head of the humerus would prove inefficient. He would prefer, instead of a chin-piece, something which would make longitudinal traction on the spine. The speaker then cited a case occurring in his practice, in which he had been able, with the coöperation the child's father, to prevent an increase of the dorsal deformity for a period of two years. The father then died, and the mother not giving such careful attention to the child, the deformity increased quite rapidly. We had all seen, in the pathological museums, specimens of caries of the spine in which the spine was straight, notwithstanding there was a large gap in the front of the bodies of the vertebræ, and it was perfectly conceivable that as soon as a spinal support was removed this portion might cave in and produce distortion. He had seen a number of cases in which there had been a notable recession of the "knuckles" in the back; just why, he could not say, unless it were that muscular spasm had much to do with the production of the deformity. Dr. Henry Ling Taylor had recorded the same observation some years ago.

Dr. J. D. Griffith, of Kansas City, said that his little girl, now nine years old, had Pott's disease of the dorsal spine, but had not been treated by recumbency except during the past twelve months. He was now using the latter method in two other cases, and both of these have markedly less deformity than his own child. If properly carried out, the treatment by recumbency does not affect the general health, and is the most successful plan for disease above the tenth dorsal vertebra.

Dr. Whitman, in closing the discussion, said that he had limited his remarks to a very small class of cases, and had directed special attention to the advantage of limiting the motion of the arms. He had been very much surprised at Dr. Wilson's enthusiastic advocacy

of some brace which would completely remove the superincumbent weight. He had never seen such a brace, and he thought the only way of accomplishing this was by recumbency. All the cases occurring in young children should be treated on the back; but one like that which he had presented would require many years of treatment, and, of course, here recumbency was out of the question.

RECENT METHODS IN THE TREATMENT OF LATERAL CURVATURE.

By E. H. BRADFORD, M.D.
BOSTON.

Within a short time the method in the treatment of lateral curvature by means of forcible correction, introduced first by Lorenz, has attracted much attention, and its efficacy proved.

It is manifest that, where the shortening of the ligaments or fascia is so great that rectification of position cannot be made by means of muscular effort, cure cannot be obtained by strictly gymnastic treatment. Patients often present themselves at a stage when a habit of faulty position has been acquired and the attitude so long continued that muscular contraction by adaptive shortening, together with a shortened condition of the ligaments, has taken place without much alteration in the shape of the vertebral bone. It is at this condition of the spine that the treatment of forcible correction is of especial value.

The treatment introduced by Dr. Sayre, of suspension, was a step in this direction ; but it is manifest that it is defective in not satisfactorily correcting rotation.

At the Washington meeting of the Association I presented to the meeting the photograph of a chair which was designed to correct rotation and increase the flexibility of the spinal column in that direction. Previous to this, Dr. Hoffa, of Wurzburg, had been using an appliance, designed for the same purpose, which he has described in his excellent work on *Orthopedic Surgery*. Since the appearance of his work I have made use of an appliance similar to his, and would report its efficiency for the purpose for which it is designed.

The patient is suspended in the ordinary way, but the body is surrounded by two half circles of steel connected with two uprights

secured below to the floor. From each of these semi-circles projects an arm, each ending in a flat plate. One presses forward so as to exert pressure on the patient's back; the other upon the thorax in front, near the connection of the sternum and the projecting ribs. The pateint's hips are held fixed, and also the shoulders, by arms projecting from the upright, and twisting is prevented, except such as is regulated by screw pressure and needed in the correction of the deformity.[1]

It has been found by practical experience that much more pressure can be exerted in this way, without causing the patient discomfort, than would at first have been thought possible. And, also, that if a daily practice of this is carried out the flexibility of the spine will increase and the rotation be corrected, and in many instances overcorrected, by comparatively slight pressure.

I have used this apparatus as a means of daily exercise, and also for the application of a plaster bandage applied to the patient in a corrected position. This was first done tentatively, but as it was found on experience that a substantial amount of correcting pressure could be applied without discomfort to the patient the jacket was not removed, but worn for a fortnight, after which a second jacket was applied in the same way.

Correcting treatment can be carried out in this way for several weeks or months, or until such time as it is thought that all possible correction is obtained, after which gymnastics or treatment by means of removable appliances can be resumed.

In applying the plaster bandage the amount of correcting pressure can, of course, be regulated entirely by the patient's comfort. Of course, an amount of pressure can be applied which would be intolerable to the patient; but with a certain amount of care it will be found that a substantial amount of efficient pressure can be worn without discomfort. The pressure can be exerted either upon a rapidly applied plaster bandage while it is still soft, and maintained until it is hard, or directly on the patient, using, instead of a metal plate at the end of the pressure-arms, a piece of thick leather-pasteboard. This will remain under the hardened jacket, the ban-

[1] Schede, of Hamburg, has recently reported an excellent appliance designed for a similar purpose.

dages being applied about the patient as close as possible around the pressure-rods.

After the bandages harden the open places left by the pressure-rods can be covered in by an additional bandage.

Although many authorities rely entirely upon gymnastic treatment it would appear that at certain stages a majority of cases of average severity need apparatus as well. In the treatment of lateral curvature it is certain that faulty attitudes should be avoided; and gymnastic exercises, only used in a certain portion of the day, cannot prevent faulty attitudes when the patient is away from the supervision of the gymnastic master.

It is, of course, true that plaster-of-Paris, leather, wood, corsets, all interfere with muscular development, and that the treatment by means of plaster jackets should be discontinued as soon as possible; and is therefore desirable, when practicable, that as light and simple an appliance as possible be worn. After experimenting with a number of appliances a few have seemed to me of use in cases in which the spine is still flexible or has been made flexible. These appliances are not to be classed as pressure appliances, but only as what may be termed a postural appliance. Apparatus of this sort should be cheap, light, and easily adjusted, and should prevent the patient leaning to the side, or to check that tendency, serving as a reminder to the patient, making it most comfortable for the patient to stand in as correct a position as is possible.

When a stage is reached where correcting treatment is no longer needed, and the stiff corsets of plaster, leather, or wood are unnecessary, the following simple appliance will be found of use: The apparatus consists of a light steel band which is adjusted to go across the lower portion of the back at the level of the hips, to which an upright of light steel is fastened, sufficiently strong as not to twist, but not so stiff but that a slight forward and backward motion is possible. It is manifest that it is essential to prevent this apparatus from slipping, and the means used are as follows: An ordinary corset waist without steel is procured, fitting well, which when buttoned is sufficiently tight not to slip down (even though considerable downward pressure is exerted) the circumference around the waist being smaller than the circumference around the hip. The steel band of the appliance is secured to this waist, either by sewing

the covering leather or by means of straps. The appliance is prevented from tilting to the side, as the corset waist cannot slip down on one side, provided it is also prevented from raising on the other. This latter is done in two ways—one by fastening the side of the corset to a stocking supporter and to a perineal band, and the other by continuing the steel upright so that at the top it presses upon the side of the patient's neck.

This steel appliance is light, cheap, and easily adjusted, and serves as a frame to which pressure-straps can be attached. These can be adjusted according to the nature of the curves. They should be applied obliquely around the patient's trunk, attached above to the upper part of the upright, passing over the projecting shoulder and side, in front of the chest, pressing upon the projecting ribs, and attached behind and below to the lower part of the upright or to the waistband, according to the nature of the curve. If the straps are tightened it will be seen that the patient cannot lean to one side but can to the other. Pressure of the straps upon any portion of the trunk can be avoided when it desirable to avoid pressure (the ribs being flattened by the distorting scoliosis) by incorporating in the straps strong steel strips shaped so that their curve is greater than the contour of the flattened portion of the thorax. A pull upon one end of the pressure-straps is transmitted to the other through the steel band without making pressure upon the protected portion of the chest. Correction of the habit of leaning to one side is made by this appliance, but the amount of forward and backward pressure upon the rotated ribs is not great. This can be increased by an arrangement similar to an ordinary truss spring, encircling the thorax and exerting pressure through plates at the desired points in front and behind.

A crutch can be added if necessary to support either shoulder.

DISCUSSION.

Dr. De Forest Willard thought there would be much difficulty in carrying out such a very painful method of treatment in these aggravated cases of lateral curvature where the curvature is so

nearly fixed. He recalled a very severe case of lateral curvature, with rotation and marked distortion, in which he had attempted forcible reduction. The corset was applied in the morning, and was fairly comfortable during that day, but the pain became so intense by night that he was compelled to remove the corset before morning, and the effects of this strong pressure were already plainly visible.

Dr. G. W. Ryan had also tried making direct pressure by means of pads applied under a fixed jacket, and had found that he could not continue the treatment. The most suitable cases for such treatment are those in which there is marked deformity of the ribs, both anteriorly and posteriorly. Regarding the cases of flexible curvatures, he said that where the improvement under suspension is quite marked he had no hesitancy in putting on a removable jacket, which he used in combination with a series of exercises modeled after those of Mr. Roth. It was seldom, however, that he continued the use of the plaster jacket for more than six or eight months, and by using the gymnastic exercises he had been able to avoid any atrophy of the soft parts, as a result of this confinement in the jacket.

Dr. B. E. McKenzie was getting rather skeptical as to the efficacy of any mechanical appliance, but at present he was trying a somewhat similar apparatus to the band and upright screw, except that the support is carried further up to the side, and is made to rest on the spine above, so as to give a point of support both above and below. In regard to the flexible curvatures, the true secret of success was in properly planned and carried-out gymnastic exercises. After trying various plans he had at last adopted that of having a capable teacher to take the patients, several at a time, and teach them to assume an erect military position—what he called "the ideal attitude."

Dr. S. Ketch said that in 1885, in a paper on "The Status of the Treatment of Rotary Lateral Curvature of the Spine," read before the Orthopedic Section of the Academy of Medicine, he had advocated exercises and the use of apparatus only as retention braces. The surgeon's first duty is to increase the lateral flexibility of the spine, and then to resort to exercises. He would like to ask

Dr. Bradford if the great force which he had used in his cases had interfered much with respiration.

Dr. Bradford, in closing the discussion, said that of course one must use discretion as to the amount of pressure to be exerted, for it did not follow that because the pressure could be tolerated for a few hours it was not excessive. More can be borne than one would at first suppose. He had made the pressure directly on the projecting ribs, from behind forward, and had not noticed any interference with respiration. Dr. Hoffa prefers to put the pressure a little to the left of the sternum, and this seems to be a valuable suggestion.

A CLINICAL CLASSIFICATION OF HIP DISEASE.

By ROBERT W. LOVETT, M.D.,
BOSTON.

It is a matter of common information that the affection known as hip disease presents itself in widely differing aspects, being at times a mild and benignant disease which runs a brief and favorable course, while at other times it appears as a malignant destructive process which is often but little affected by the therapeutic measures at our command. Between these two extremes many intermediate degrees are represented practically, so that the condition described as hip disease stands for an affection which varies within very wide limits.

So far as I know there has been no attempt made to formulate these different aspects of the disease, and no definite classification of types, if there are any, has ever been presented. And yet such a classification, could it be made, might be of the greatest practical value. If the different phases of the disease could be recognized early, much might be gained, not only in the study of the affection, but as an aid in the prognosis and treatment. If, for example, a classification could be made and certain cases recognized fairly early as belonging to the rapid, destructive form which we all know so well, then more radical and more stringent methods of treatment might be undertaken, which might make an important difference in the outcome of the disease in those cases.

Such a classification, of course, should rest on a pathological basis if possible, but one has only to survey the field of the pathology of hip disease to realize that such a pathological classification is not for the present feasible. It is only of late years that hip disease could be said to have any pathology at all, and now we know little more than that the affection generally begins as a

tuberculous ostitis of the head of the femur, and passes on to affect the synovial membrane and in most cases to eventuate in a more or less destructive inflammation of all the joint structures. This we know from certain early autopsies and from the work of those surgeons who believe in and practise early excision.

But what symptoms are associated with the involvement of the various structures we do not know; we may theorize upon the subject, but we have no pathological knowledge sufficient to enable us to assert that certain phenomena mean that the bone is affected, or that certain others mean the involvement of the synovial membrane in other than exceptional cases.

Certain writers claim to be able to diagnosticate between synovial and osseous disease, and even between femoral and acetabular hip disease. I fancy that the majority of us feel unable to make these distinctions in general, however evident they may be in exceptional cases. I can only speak for myself in saying that it is a diagnosis that in most cases I feel utterly incompetent to make, and that until the clinical symptoms are more accurately associated with the pathological conditions which cause them, it seems to me that a pathological classification of that sort is premature, and likely to be of little practical value. On the other hand, if the disease can be subdivided clinically and so studied, and if these clinical types are found to be associated with different types of a common pathological process, it seems to me that such a method will best serve the more accurate study of this disease and will lead in time to an accurate pathological classification.

It is such a clinical classification that I have to present to you, which I hope to demonstrate rests on a pathological basis after all. It is necessarily a preliminary paper to a certain extent, and I have been much hampered in its preparation by my lack of knowledge of practical surgical pathology.

Hip disease, I believe, falls into four well-marked types, each of which corresponds to a particular type of the pathological process.

These four types are:

(*a*) *The Destructive Form*, where the disease is rapid, severe, and but little influenced by ordinary treatment; extensive infiltration of the soft parts takes place, and in most instances the disease passes on to a fatal issue.

(*b*) *The Painful Form,* where pain is a prominent symptom, and exacerbations are common.

(*c*) *The Quiet or Painless Form,* where pain is an unimportant factor or is entirely absent.

(*d*) *The Transient or Ephemeral Form,* where the symptoms are mild and the course of the disease is run in a few months.

(*a*) *The Destructive Form.*—The type of hip disease which I would place in this class occurs most often in children of tuberculous inheritance and poor vitality. Its onset is rapid and painful, often excessively painful. There is, almost from the first, much thickening of the trochanter and peri-articular tissues. The general condition is rapidly impaired, and abscess formation takes place early. One abscess follows another with profuse discharge through sinuses which open widely and are surrounded by colorless granulations. This type of disease most often begins as such, and is clearly a type by itself throughout. At other times, but rarely, it is superadded to one of the forms about to be described. The temperature is high, the wasting rapid, and a porky induration of the thigh ensues.

Such children, as I have observed them, die most often of exhaustion; they are particularly liable to tubercular meningitis and, if they live, it is these cases that develop amyloid degeneration. The course of the disease is rapid in most cases, and the prognosis is poor. Under favorable conditions a certain proportion recover with stiff and shortened legs, others are saved only by excision.

It seems probable that in some of these cases at least, the disease is an acute infectious osteomyelitis, not necessarily produced by the bacillus of tuberculosis or by any specific bacillus, but, being a local septic process, a pyæmia, caused most often by the staphylococci, exceptionally by the streptococci. The rapidity and the destructive character of the process in some cases point to a pathological state more likely to be due to a process of this sort than to tuberculosis.

In other cases it is doubtless merely a tuberculosis of unusually rapid and extensive character. Certain individuals, either by inheritence or by peculiarity of constitution, offer a most favorable soil for the rapid development of the tubercle bacillus, and if these individuals should happen to receive a large initial dose of the

poison, it is not unreasonable to expect that in them the disease would be extensive, rapid, and destructive.

Probably the infiltrated form of tuberculosis is more common than the encysted form in these cases. The whole spongy tissue of the epiphysis is probably suddenly filled up with a creamy tuberculous infiltration which degenerates most rapidly and erodes most extensively the surrounding parts. In other cases the encysted form is probably present but possesses unusual capabilities for destructive and rapid growth. So that, just as in pulmonary tuberculosis the florid form of phthisis stands off from the more chronic manifestations, in bone tuberculosis one finds a rapid and destructive form of the disease.

(*b*) *The Painful Form.*—This, the commonest type of hip disease, is described as the painful form for want of a better name. It serves to distinguish it from the quiet or painless form to be described next, yet it is only descriptive of one symptom. The cases that I have in mind are those irritable cases which form the bulk of the disease where pain is caused by manipulation and is present in the form of night-cries and continued pain. It is not steadily present, and is controlled to a greater or less extent by treatment, but the tendency to pain exists, and painful exacerbations come on spontaneously or are caused by slight traumatisms.

Muscular spasm is, of course, an integral symptom of all forms of hip disease, and is always present in painful cases as in the others. Generally some motion is allowed in the joint, but the muscles are quick to catch and hold the joint when the limit of motion is reached.

Malpositions of the limb are very common and come on rapidly, generally with an exacerbation of pain and with complete muscular fixation, but they yield readily to treatment, and motion returns to the joint to a certain extent. In short, the muscular spasm varies so that while most often considerable motion may be allowed in the joint, again complete fixation may be present for a longer or shorter time. Abscess formation is common in this form and is most often preceded by an acute exacerbation of pain. Thickening of the trochanter is always present, but is moderate in amount.

In short, the type is the common one to be found in hip disease. It occurs more often in children under six years than does the

painless type, and although the term "painful" describes only one feature of it, this feature is the most characteristic and the most persistent. Joint irritability, pain, and rapid deformity are its striking characteristics.

The general course of the disease, I believe, is shorter than in the painless form, to be described next, and the joint likely to be a better one after the disease has run its course; consequently I should be inclined to give a better prognosis as to a rapid and favorable issue, other things being equal, than in the quiet and painless type of the disease.

(*c*) *The Painless or Quiet Form.*—This name represents, it seems to me, a well-marked and distinct type of hip disease which we can all recognize. It seems, moreover, to apply to a certain type of joint disease in general, but that is aside from the present question.

In the hip there is undoubtedly one form of inflammation that runs its course quiety, slowly, and with little or no pain; it is these cases which I have included in this type. Pain as a prominent symptom is absent, although night-cries may be present early in the disease, and later a painful stage may be brought on by a fall or by some traumatism to the joint. In general, muscular spasm is the important and prominent feature in this form of the disease; it is persistent and most often allows no motion, but holds the joint rigidly fixed. Passive manipulation is not painful, but fails to move the joint.

The malpositions in this form occur slowly and are much more persistent and intractable than in the painful cases, and yield very slowly to treatment. Thickening of the trochanter is considerable, but the atrophy and shortening of the limb are more marked than in any other type of hip disease, being often extreme. This quiet and comparatively painless type of hip disease is more likely to occur in children over six years of age than in younger children, and it is not so liable as the other forms to occur in children of a marked tuberculous taint. Such cases are common enough; some go through the whole course of the disease without any pain, while others have it only temporarily, perhaps as the result of some traumatism.

In general this type runs a slower course, is less likely to abscess formation, and is likely to end in a stiff joint. It is not so likely

to mishaps as the preceding form, but the functional results are not apt to be so good in the matter of motion, shortening, or atrophy.

The pathology of painful and painless hip disease can best, perhaps, be discussed in one place. In general the presence of foci of tuberculosis in the head of the femur is not in itself likely to excite pain except when the foci are near enough to the articular surface to involve the synovial membrane in the irritation which surrounds them. But a large proportion of active foci of tuberculosis which form about the epiphysis are on the articular side of the epiphysis and grow toward the joint surface, consequently it is reasonable to suppose that most active foci will cause synovial irritation and pain in the course of their growth. The early autopsies of Lannelongue have shown more clearly than anything else that pain begins when the synovial membrane becomes affected; but that the synovial membrane is often affected without the occurrence of pain, is shown by daily observation in advanced cases of hip disease where pain has never been a symptom. For this reason I take it that painful hip disease represents the ordinary form of bone tuberculosis where foci form in the epiphysis and involve the joint in their growth. They are surrounded by a zone of hyperæmia and irritation, and generally break down into pus. This is the most common form clinically and pathologically.

Cases without pain, which I have classed as painless or quiet cases, I assume are caused by a different form of bone tuberculosis, a well-recognized form pathologically where the tendency is not toward purulent but toward fibrous degeneration. The older name was "caries sicca," but the newer pathology, in dropping the term caries, speaks of it merely as a fibroid form of bone tuberculosis.

The process in general is the same as that of ordinary bone tuberculosis, except that the foci are surrounded by less irritation and hyperæmia, and in place of it a condensing process goes on around. It is a bone tuberculosis just as the other is, but it causes much less irritation around it, it is slower in its progress, and it has little or no tendency to purulent degeneration. It is a well-recognized type of bone tuberculosis and its characteristics are well established. It must be evident that it seems to furnish a reasonable pathological explanation for those cases of quiet or painless hip disease which

are not by any means the most common manifestation of the disease, but which are so common as to be familiar to us all.

(*d*) *The Transient or Ephemeral Form.*[1]—I have included under this head those somewhat unusual cases of hip disease which begin in a typical way, but subside in the course of a few weeks or months. These cases would at first be set down as due to simple acute synovitis, but some of them show plainly enough that there is a bony lesion at the foundation of the trouble. They simulate cases of acute synovitis very closely, of course.

A typical case is the following: Frank F., eight years old, came to the Children's Hospital in September, 1889, six weeks after a slight fall. He was lame; he had night-cries and pain; and the trochanter was slightly thickened. Flexion, hyperextension, and rotation were all limited by muscular spasm. The diagnosis of hip disease was made, but recovery was unusually rapid, and in three months motion was free. Two years and a half later there is shortening of one inch in that leg; no atrophy, but marked trochanteric thickening; motion at the joint is free.

Here there is a case which seems to be a true bony lesion affecting the growth of the bone, which recovered permanently in three months. Such cases are not altogether uncommon, even when cases of pure acute synovitis are left out of account.

The early symptoms of these cases give no clew to the fact that they are not routine cases of hip disease. Muscular spasm, pain, atrophy, night-cries, etc., are all present, and the case in every way resembles the beginning of mild hip disease. It is only in the light of its later history that its true character becomes evident.

It will be seen that these cases do not present any early symptoms different from those of hip disease of the common type, so that their recognition seems impossible; moreover, hip disease is characterized by such marked remissions of symptoms that this type of disease is easily simulated in that way. But the fact remains that, even if one leaves out of consideration cases of acute synovitis, certain cases presenting all the symptoms of true hip disease run their course to a favorable termination within a few

[1] R. W. Lovett and J. L. Morse: A Transient or Ephemeral Form of Hip Disease. Boston Medical and Surgical Journal, August 18, 1892.

weeks or months, and the matter is one of such practical importance that it deserves recognition.

With regard to pathology, all must be conjectural. It is probable that in these cases the focus of tuberculous disease is situated in a part of the epiphysis remote from the joint, and that in its growth it causes enough disturbance in its neighborhood to give rise to symptoms of joint irritation. Having caused these symptoms of joint irritation, it seems probable that the focus of disease either becomes quiescent or grows away from the joint if it continues active, and after a brief time the symptoms subside once more.

Allow me once more to name these types of disease:

(*a*) *Destructive Hip Disease*, due to a florid tuberculosis of bone or to an acute infectious osteomyelitis.

(*b*) *Painful Hip Disease*, due to an ordinary form of focal bone tuberculosis, where irritation surrounds the foci and the tendency is to purulent degeneration.

(*c*) *Painless or Quiet Hip Disease*, due to the fibroid form of focal bone tuberculosis, where there is little irritation surrounding the foci and a tendency to the deposit of fibrous tissue.

(*d*) *Transient or Ephemeral Hip Disease*, due probably to a focus of tuberculosis, which is rapidly absorbed or is so far removed from the joint that it causes little or no synovial irritation.

Whether or not these types will meet with your acceptance, I have no means of knowing. Any classification in our present state of knowledge must be to a certain extent a preliminary one and subject to change when our knowledge of pathology becomes more extensive. I present it purely as a clinical classification, moreover, although I have tried to give it a pathological foundation. The types are not always well marked, and border-line cases are common, but that is the case in any scheme of classification, pathological or clinical. I offer it in the hope that it may serve some of us in a more accurate study of the disease.

DISCUSSION.

Dr. L. A. Sayre said he was contented to make a positive diagnosis of simple hip disease without making these minute subdivisions.

Dr. A. M. Phelps thought the Association was much indebted to the author for this excellent paper, which was particularly important as regards its bearing upon the prognosis. He could heartily indorse this classification, which was in harmony with some observations which he had himself made. The transient cases are a true variety of the disease. Infection cannot take place in any form of hip disease until a lesion has been produced by trauma, embolism, or some other cause. After this, the normal process of repair takes place which we call inflammation, and inoculation in this area produces tuberculosis of the hip-joint, or, if pus germs are introduced, osteomyelitis. In the ephemeral variety he believed a post-mortem study would show that no inoculation into the area of disease had occurred, but the normal process of repair had been interrupted by trauma.

Dr. H. A. Wilson, of Philadelphia, said the paper enables us to look at a very practical side of the subject, for we need no longer look upon it as one unvarying disease, requiring the same unvarying treatment. Our recent text-books on surgery still teach that hip-joint disease is a disease divisible into three stages, but having one method of treatment, which is applicable to the whole course of the disease. The author's description was very accurate, both pathologically and clinically.

Dr. Roswell Park thought the study of hip-joint had been unnecessarily obscured in the past by its name. It is a type of a disease process which may occur at any other joint, and, therefore, morbus coxæ is a much better name than hip-joint disease. He had hoped the author would treat more fully of the pathology. Looking at it from this standpoint, the speaker was forced to consider two forms: the synovial and the osseous, and the same pro-

cess may obtain in either case. There may be (1) a very acute tubercular form, corresponding to miliary tuberculosis of the lung; (2) a slow tubercular process, corresponding to ordinary consumption; (3) an acute pyogenic infection; and (4) a slow or a mixed form.

Regarding the first form, he was fully convinced that in bone, as elsewhere, there may be an acute tuberculous osteitis, which may be rapid, and may destroy the bone as quickly as it would kill an individual, and we know that may occur in two weeks. In one case of acute osteomyelitis he had to amputate at the shoulder-joint on account of the disease involving the whole upper extremity. Not enough had been said of the acute pyogenic infections due to staphylococci or streptococci. It is more rapidly destructive even than the acute tubercular form. The acute pyogenic form may degenerate into a slower type, which may subsequently become complicated with tuberculosis, or, as much more commonly happens, a slow tubercular process becomes infected with pyogenic organisms, resulting in a mixed infection and abscess formation. Various pathological researches show that the tubercle bacilli may by themselves be pyogenic organisms; but, nevertheless, most cases of suppuration of tubercular focci are due to secondary pyogenic infection. The difference between the author's destructive and painless forms is mainly one of pyogenic infection. The speaker said he had often insisted that what goes on in tubercular disease of bone finds its counterpart in the tubercular processes in the lungs. It is well known that a fibroid form of phthisis, while not exactly a recovery from the diseases, is still considered to be a very favorable process. Similarly, the prognosis is much more favorable when the disease of the hip-joint is of a non-suppurative form. He had some doubt, however, about this form being really so fortunate as would at first appear, for, in his opinion, it is better for a case in the hands of a competent surgeon to go on rapidly to the formation of abscesses, and to an early resection, than to have the lingering fibroid process, as complete recovery under these circumstances never occurs, and yet the process is not sufficiently active to demand a resection. In answer to a question as to whether he considered the destructive variety to be an acute and unusually rapid tuberculosis, or an acute osteomyelitis of a non-suppurative character, Dr. Park said that he

looked upon it as an unusually rapid tuberculosis, but with this acute form there is almost always secondary infection.

Dr. H. L. Taylor had been very greatly interested in this most suggestive paper, and hoped it would be a point of departure for a more definite and special knowledge of the pathology of the hip-joint and of other joint affections. While the classification presented will most probably be modified, it is very desirable that we should become acquainted with the different types which this disease undoubtedly presents, and which at present we can only imperfectly distinguish. Still, he could not agree with one of the speakers who thought that each separate type would require radically different treatment; at the most, the general indications for treatment would only require modifications of detail to adapt them to each special type. Moreover, it would be unfortunate if, in our desire to attain a more exact knowledge of the pathology of this affection, we should lose sight of the enormous benefits to be derived in nearly all types of the disease from keeping prominently before the mind the primary idea of proper treatment by counter-extension. As muscular spasm about the joint is the central symptom of all these types, and the prompt disappearance of pain under proper use of traction shows how efficiently this important indication for treatment is fulfilled, there should be no hesitation in making this the central point in our treatment. He had understood the author to say that he could not himself distinguish clinically all these evanescent forms, and, therefore, there was considerable danger of our mistaking a really grave case for one of these mild ones, and employing treatment which is wholly inadequate. Again, it was not uncommon in many cases of hip-joint disease to have periods of exacerbation, followed by periods of quiescence, irrespective of the kind and time of treatment. This applies also to other joint diseases, and to Pott's disease of the spine, and one of the most common and disastrous errors is to mistake such a period of quiescence for one of complete recovery. This can be avoided by careful attention to the crucial symptom—muscular spasm.

Dr. J. E. Moore, of Minneapolis, was grateful for any practical classification, and at present a clinical one was probably the best

obtainable. Such a classification greatly simplified the work of teaching this subject.

Dr. G. W. Ryan, of Cincinnati, thought that no classification was strictly entitled to this name which was not based on pathological conditions, and he thought we were ready for such a classification. He believed that he had been able to make a pathological diagnosis, so to speak, in many cases, thus: where there were acute symptoms he had looked upon the cases as belonging to a distinctly tubercular disease, beginning in the soft parts, just as in young children with the painless type of the disease, he felt sure the disease was in the bone, and had not yet invaded the soft parts.

Dr. Lovett, in closing the discussion, said that he had been much hampered in his work by a lack of practical pathological knowledge, and he desired to express his indebtedness to Dr. Park for many valuable hints on this subject. He did not feel, as did the last speaker, that he could make a pathological diagnosis, and hence he had made this clinical classification, which would serve to associate the clinical symptoms with the pathological conditions. He had not been able to settle in his own mind the question as to the persistence of these types, and he recalled seeing, when a student, some cases of hip disease which were doing admirably without treatment, whereas other cases were doing very badly under the best treatment. The subject he had presented was comparatively new, and progress could best be effected by the coöperation of the members of the Association.

PLASTER-OF-PARIS IN ORTHOPEDICS.

By A. J. STEELE, M.D.,
ST. LOUIS.

Last year, in my review of the orthopedic work of the late Mr. Thomas, I observed how rarely, if ever, he made use of plaster-of-Paris. I, however, do recall one instance: it was when the wire cuirass, which he suggests for the treatment of Pott's disease, was shaped over a plaster cast of the patient's back. Doubtless some convenient Italian was called in to do the work. Had Mr. Thomas's armamentarium been enriched with gypsum in its manifold applications, even he might have done better work and obtained still more brilliant results. Nor do those of like limited practice, as was his, realize what a valuable agent is to be found in this article for immobilizing joints and for retaining parts of the body in improved position after forcible rectification.

The property of rapidly hardening, when once wet, gives to plaster its value. Additionally it has merit in its cheapness and convenience; it is ever ready, is easily prepared, and simple in its application. Its use renders the surgeon in many instances quite independent of the commercial instrument-maker—a consummation devoutly to be wished, for the latter too often assumes the rôle of doctor, both advising and applying the remedy. Without anatomical or pathological knowledge, and too often without judgment, he applies a stereotyped machine, charges generous prices, and consumes for the patient golden moments when correct treatment, directed by the intelligent surgeon, could have saved a limb or prevented a deformity in a child otherwise doomed to life-long disfigurement. These proprietors of surgical instrument shops are as culpable as the class of prescribing druggists. By their illustrated advertisements and display of showy apparatus in shop

windows and at public fairs the people are impressed with the idea that to them they should apply for relief. The profession itself merits a share of blame in this matter. Its members having cases of deformity, too often very willingly turn them over to the instrument-maker for apparatus without having any idea of what is best suited. In fact, having pocketed the consultation fee, are glad to get rid of cases about which they know but little and with which they do not care to be troubled. The set appliances which these mercantile surgical instrument men handle are very like the patent medicines which can be used without the aid of a doctor.

A better day, however, is now rapidly dawning, when the people, as well as the general profession, are beginning to understand that the successful treatment of deformities in their intricate and chronic peculiarities requires the intelligent guidance of specially educated and experienced surgeons. The advanced work of this Association in correctly educating the profession in these matters is redeeming the poor cripples from the unprincipled hand of charlatan and mere mechanic.

Welcome, say we, to the intelligent and skilled artisan who can fashion the willing steel according to the ideas of the orthopedic surgeon; he becomes our right-hand man—like the pharmacist to the physician, valued where needed. It is, however, always better when the surgeon can do his own work, for he best knows what is required. Thus the intelligent use of plaster-of-Paris often renders us independent of the machinist; we accomplish results, and cheaply too, economizing time and, to the patient, money. With its use there is no interruption of treatment for repair of broken braces, often a serious matter to the country practitioner far removed from the urban instrument-maker.

We, as surgeons, are largely wedded to methods which have been taught us and with which we are most familiar. Thus a few orthopedists limit themselves to steel bars and leather straps, ignoring the use of plaster because unfamiliar with its manifold virtues. I, however, opine that all those now entering the orthopedic arena will, among their other accomplishments, be expert in the use of the plaster bandage.

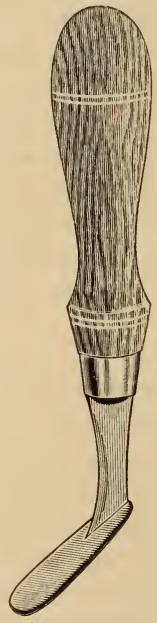
Those of us who employ this bandage differ in some of the minor details of its preparation. Thus not a few prefer the crin-

oline into which to rub the plaster, some previously removing its starch by washing. Individually I prefer the so-called (Holstein) butter-cloth; it is more open-meshed than the cheese-cloth, and nearly as much so as is crinoline, and is one-half its cost. Bought by the bolt, it may at once be cut into convenient widths at the book-binders, or in twenty-yard folds, with a sharp cobbler's knife on a cutting-board against a steel straight-edge or square. Three- and four-inch strips are none too wide for application to the trunk; they may be narrower for the limbs and still more so for infant feet. These strips are cut in desirable lengths—here again longer for the trunk and shorter for the limbs. This can be done as each individual strip is being sprinkled with fresh dental plaster—most economically purchased by the half-barrel; also to be had in two-gallon covered tin buckets. For preparing the bandage we may use any one of the ingenious plaster bandage rollers to be found in the market, but will probably return to the hand for sprinkling, rubbing, pressing, and loosely rolling the strip, best done on a table-top entirely covered with a piece of stout wrapping-paper, which is afterward gathered up and the loose plaster shaken into the large tin bucket plaster-holder, then folded and put away for future use. With proper care no scattering of the loose plaster need be made. For the same purpose, also, Dr. Weigel has devised a board with slightly raised sides, and a box attached to one end filled with plaster, through which the bandage passes while being rolled on the board with the hand.

The rollers are put away in a tight tin can and kept in a dry place until needed. When required for use they are soaked in warm water. As my own are tightly rolled, I keep three or four soaking during the application, always placing the last one in the water the farthest removed from the hand, that they may be taken out in the order of their placing. A pinch of salt previously dissolved in the water hastens the hardening when desirable, but increases its brittleness. I rarely employ it, except when making moulds. In applying the bandage, much tension ordinarily should not be used, as unevenness thereby results, and consequent discomfort to the patient. Each round is made to overlap its predecessor one-half its width, and rubbed smooth. Reverses are rarely required. The plaster is not applied directly to the skin, a shirt, a

stocking, a flannel or sheet-cotton bandage being interposed. A few moments suffice for hardening, when, as a result of the application, we have a firm, fixed dressing. Should it be desirable to remove it at once, a pencil-mark is made in the line of proposed cutting, and with an ordinary pocket-knife a V-shaped groove is cut the whole length of the splint. By inserting the index finger of the left hand under one end of the splint the plaster, with its lining, can be completely divided without touching the skin; or a corset steel may be passed under, next the skin, and it cut down upon; or, preferably, an instrument, such as I have devised, may be used. It consists of a small steel plate, half an inch wide and two inches long, fixed on its flat upper surface to a handle. This surface is plated with zinc, that the knife-blade be not dulled as it cuts down upon it.

Fig. 1.



Skin-protector.

The plaster splint having been cut through, or nearly so, by a gutter-shaped incision, V-like, the flat blade of the instrument is slipped under the plaster next to the skin, and cut down upon

with a sharp knife and slowly advanced until the whole is divided. A freshly applied splint cuts readily, whereas an old splint may be so hard as to require softening. For this purpose nitro-muriatic acid was formerly advised, but is unnecessarily strong, and might burn the patient's skin. I find vinegar, ever at hand, sufficiently strong to soften the plaster, which may be freely scratched with a knife-blade in the line of proposed incision, and the vinegar plentifully dropped on with a pipette. The plaster soon softens, and is easily cut. Various shears and saws have been devised for dividing the plaster. One form of the latter, suggested by Dr. Meisenbach, consists of two equal-sized saw-blades, shaped like the Hey's saw, three-eighths of an inch apart and parallel, attached to a strong handle. In use it not only divides the plaster, but removes a strip, so desirable when the splint is to be reapplied, that it shall be tight, for plaster splints to the limbs and plaster jackets to the body become loose, fit less snugly, after being worn a while, from atrophy

Fig. 2.

Saw, double and single bladed, for dividing plaster splints.

of the soft parts. One of the blades may be removed by loosening the thumb-screw at the side, and thus the saw be used to make a single cut. It is unnecessary to soften the plaster when a saw is used.

For dividing splints, however, I prefer a sharp pocket-knife, a little vinegar, and my skin-protector. Some fancy a hooked knife-blade, shaped like a gardener's pruning-knife, but it cuts too much on the point and is apt to wound the skin.

Fixed splints that have been made removable by cutting, may be bound on the edges and fastened with hooks or buckles or with an ordinary bandage, and thus taken off and replaced at pleasure.

The plaster bandage is not only useful for making splints, but also for taking moulds of any part of the body. The part being covered with some light snug-fitting stuff, the wet bandage, well

soaked, is applied loosely, without tension, as otherwise ridges will be made and unevenness result. The bandage is allowed, so to speak, to adapt itself, and is smoothed down with the hand and gently forced into any depressions. Less plaster is used than in the case of a permanent dressing. In a few moments the incasing splint is sufficiently hardened to be cut off, which is done in the manner already suggested; the shirt, stocking, or whatever else covered the skin, being removed with it and becoming its lining. The more sleazy this material the better, for it adheres all the more closely to the inner surface of the mould. While I advise so, yet it is not absolutely necessary that any material should cover the skin, for the plaster bandage may be applied directly to the part if previously well soaped or greased; but in this case so fine a surface is not given to the resulting cast. After removal the cut edges are nicely adapted, and the whole wound around with twine. So rapidly does the plaster dry that one may proceed directly to make the cast, or the mould may be laid aside for future use.

The line of union of the cut edges is stopped with fluid plaster applied to the outside, and, if it is a body mould that has been made, the lower open end is placed on a rough board and stopped around on the outside with plaster. Then ordinary commercial plaster, mixed with water in a large earthen bowl to the consistency of cream, is poured into the mould. This is to be repeated as often as necessary, until the mould is full. If the cast had been made on a smooth table-top the mould would not have adhered, but would have risen and allowed the liquid plaster to escape at the bottom. The rough, sawed surface of a pine board affords strong attachment for the plaster, thus precluding such an accident. If a cast of the trunk is being made, plaster can be economized and the cast made lighter by forcing down into the centre of the fluid plaster round tin cans. Casts of limbs are made solid, and are strengthened by bundles of wire or several iron rods passed through them lengthwise. One end, the lower, is closed by tying over it rubber or other cloth previous to pouring in the plaster.

In half an hour or more the plaster will have sufficiently set to allow removal of its outside mould. A sudden force readily separates the cast from the board. The plaster that was used for stopping is now chipped away, and the mould, with its lining, is

readily peeled off, leaving the cast intact. Trouble is rarely had with the plaster of the cast adhering to the inside of the mould. Did one fear such a contingency, smearing the inside of the mould with lard would prevent it. The cast requires pointing up, and if desirable may be reshaped, adding here and taking off there; this had best be done at once while it is still moist and comparatively soft. The thin and sharp blade of an old case-knife answers as a tool, though others, especially made for the purpose, are convenient. Casts made as thus detailed answer all purposes except where great hardness and toughness are required, as when they may be subject to blows of a hammer as in shaping the wood-and-glue jackets. In such case finely picked tow is thoroughly incorporated into the fluid plaster, and the inside of the mould, probably of the trunk, smeared all around with it to the thickness of three inches, more or less. On removing the outside casing or mould there remains a light but very tough cast.

Casts are desirable either for preserving the form of a distorted part or over which to shape splints. There is scarcely a deformity but what can be well taken in this simple manner, and I cannot too strongly urge the importance of obtaining and keeping casts of our deformed cases, especially the rare ones. They have place in the history of the cases and are valuable for illustration and instruction. None should be deterred from attempting to make them; the process is so simple and rapid that anyone may soon become an expert, whether they are made as above detailed or after the old method, with fluid plaster poured directly upon the skin.

Dr. Whitman, in making a cast of the foot, toes excepted, suggests that thickly mixed plaster be poured upon a square of cotton cloth, and the outside of the foot be allowed to sink into it, the edges of the cloth then being raised until more than one-half of the foot is covered. When this is hard, vaseline is spread on its upper surface, and the exposed surface of the foot covered with more plaster. When hard, the two halves are removed; and their inner surfaces oiled and bandaged together, and the interior filled with fluid plaster. The outer shell being removed, a cast is had of the part.

A few words as to the use of the plaster bandage in various affections and in different regions of the body. Gypsum had been recom-

mended as a convenient material for treating fractures by Mathiesen, of Holland, as early as 1852, but the plaster bandage was first employed for the relief of a deformity in 1875, the affection being Pott's disease; and it still holds its place as an economical and efficient support to the body in spondylitis, especially of the lumbar and of the lower and mid-dorsal regions. The novitiate in its use finds trouble in the excoriation or ulceration of the skin that often occurs over the boss. To prevent the undue pressure and friction which causes this, I cut an oblong opening in a sufficiently thick piece of boiler felt and place it over the projecting spines, care being taken that it does not shift as the bandage is drawn around. Boiler felt makes, also, efficient pads for the hip bones in adult patients. Usually the plaster jacket is made to extend above not higher than the axillæ; but if the disease is in the mid- or upper-dorsal region more efficient support can be obtained by carrying the bandage above the shoulders, like a vest. I cannot say whether or not I was the first to adopt this plan—now some twelve years since—but certainly support for three or four additional vertebræ can thus be had. And with the disease in the cervical region the bandage has been carried still higher, up the back of the neck and around the head. To additionally strengthen the jacket I fortify it with strips of galvanized wire gauze, the size and strength depending upon that of the patient; the corners are cut off, and the edges bound with adhesive plaster. The gauze incorporates with the plaster better than perforated tin.

In lateral curvature a plaster jacket or corset gives support and comfort, but is not used as a corrective of the deformity.

The use of the plaster bandage has almost revolutionized the treatment of club-foot in the past dozen years. Through its aid we now do at one sitting what formerly required many weeks. Under an anæsthetic the foot is at once straightened, with or without tenotomy, depending upon the age of the patient, and so held by the plaster, a sheet-cotton roller having been first applied to the part. Here again I find valuable aid in a strip of wire gauze. A layer of plaster bandage having been placed over the foot and leg, one end of a narrow gauze strip is carried around the foot, and, while it is forcibly held in corrected position, the other end is car-

ried well up the outside of the leg and there fixed with additional rolls of the bandage.

In hip disease, the joint may be quite efficiently immobilized by a plaster bandage carried well up on to the trunk and down to the lower third of the leg—a ready method for the country practitioner far removed from the instrument-maker, or when economy is necessary. In the immobilization of the knee-joint, however, the bandage finds more suitable adaptation. The limb being covered with a long stocking or drawer leg, and the articulation surrounded by cotton, the plaster is carried well up on the thigh and down upon the leg, and fortified with metal gauze strips on the sides, thus affording a cheap and efficient splint. If, however, the patient is much on his feet this splint tends to drop—to downward displacement. This may be prevented by giving it support through a steel arm extending to the sole of the shoe, or it may be suspended by straps from the opposite shoulder. I have also used adhesive plaster for fixing the splint to the skin of the leg at time of application.

In disease of and in sprains of the ankle-joint, plaster finds frequent and admirable application, care being taken that the foot is put up at a right angle, not extended. To the elbow- and wrist-joints plaster in certain cases is applied for immobilization, well meeting the indication; care being exercised here, as wherever the plaster bandage is applied, that it is not wound around the part so tightly as to produce undue constriction, interference of the circulation, with consequent sloughing. The appearance of the part distal to the bandage, as of the fingers or toes, will indicate danger by coldness, swelling, and discoloration, when immediately the plaster should be cut off. A case of malpractice is now pending in our courts where a doctor applied a plaster dressing to a boy's arm for a fracture extending into the elbow-joint, which was followed by extensive sloughing of the forearm.

In both in- and out-knee, and in tibial curves after forcible manual correction or after osteotomy, the plaster splint holds the limb in the desired position until union takes place in the latter case, or accommodation changes have fulfilled the indications in the former. In manual correction of genu varum or valgum I change the splint every three or four weeks.

In wry-neck, after myotomy and rectification, the bandage from a body-jacket is continued up back of the neck and around the head, thus firmly holding the parts in corrected position.

Having subcutaneously tapped a ganglion and scarified the interior of the sac with a spear-pointed instrument like a couching-needle, and effectually pressed out the contents, I apply a firm pad, and put up the wrist in a flexed position with a plaster bandage extending down the forearm and including the hand. Obliteration of the ganglion universally follows.

I might multiply the instances where this bandage finds admirable and convenient application, but will rest with the suggestion that as one becomes more expert in its use the more often will he find wise occasion for it.

DISCUSSION.

Dr. De Forest Willard, of Philadelphia, said that the more one used plaster-of-Paris the more one was likely to continue to use it, and the better would be the results. The mishaps which occur are usually attributable to faulty application, for, unquestionably, the slightest inattention to details may result most disastrously. It is a good plan to nearly cut through the plaster before it becomes hard.

Dr. Ap Morgan Vance, of Louisville, had used leather for many years, for a long time moulding it over a plaster cast in the manner described in the paper, but he had been able to secure by immersion in boiling water the same degree of hardness which the author attains by the baking process. If the perforations are made in the leather before it is moulded it will be found to be more pliable.

Dr. G. W. Ryan recalled a useful hint given him by Dr. Sayre, viz.: to place a strip of tin between the bandages directly in the median line, and then, before the plaster has entirely hardened, one can very rapidly cut down upon the tin with a sharp knife without any danger of cutting the patient.

Dr. John Ridlon, of Chicago, exhibited a convenient pocket-knife which he had made for the purpose of cutting plaster-of-Paris. There is a pruning blade a little shorter and a little thicker at the shank than usual, a pen blade, and a nail file with a burnisher.

Dr. R. H. Sayre saw no occasion to use vinegar or nitro-muriatic acid to soften the plaster when water would accomplish the same purpose equally well. In making plaster casts it is better to grease the limb and apply the plaster cream directly, as in this way the more delicate details are not obliterated, as they are when a cloth intervenes between the skin and the plaster.

Dr. L. A. Weigel, of Rochester, said that a proper grade of crinoline would take up the plaster much better than cheese-cloth, and was better than the latter on account of the starch which it contains, which adds greatly to the elasticity of the plaster splint or jacket. The tin strip he had always used, and in making plaster casts he had found a board or a marble slab equally serviceable. Hand-made plaster bandages are far superior to any made by machines, but the time and labor ordinarily involved in their manufacture may be materially reduced by passing the bandage through the bottom of a box and out of a slot; then, as the bandage is wound up by hand, the edge of the box rubs the plaster thoroughly into the bandage. The methed of carrying the bandage up over the head or around the neck was published some years ago in the *Berliner klinische Wochenschrift.* In order to secure lightness and economize plaster, it is desirable that the plaster cast should be made hollow. This is best accomplished by closing one end of the mould, and revolving it with the plaster in it. Such a cast dries much more quickly than a solid one. A good working rule to remember when using leather is, that water at a temperature which will not burn the hand will not burn the leather, as it is an animal tissue.

Dr. B. E. McKenzie said that for the past six months he had been using raw-hide, and had been much pleased with it. It is very pliable when wet, can be easily moulded over the cast, is more truly elastic, and does not yield under the warmth and moisture of the

patient's body. The raw-hide jacket is placed near a range or register to dry. This sometimes takes as long as two weeks, but when once thoroughly dried it will not curl. When plaster cream is poured into a plaster mould the mould absorbs the moisture so rapidly that many of the details are obliterated. Dr. Peters, of Toronto, makes most beautiful casts with paraffin, which reproduces the minutest details most perfectly.

Dr. A. M. Phelps said that he had yet to see a case of Pott's disease of the spine in which a leather or raw-hide corset, though applied by competent men, gave proper support, or which did not grow worse under its use. Either these corsets do not fit, or they are taken off by the patient or the friends, and the speaker was opposed to any appliance which could be so removed being used in Pott's disease, except in the convalescent stage. For Pott's disease a plaster-of-Paris corset was the best, and for lateral curvature nothing was superior to the wood corset.

Dr. S. Ketch had never seen a case of joint disease in which a plaster-of-Paris splint had given proper immobilization. One of the dangers of using plaster is the inclination to leave it on so long that the soft parts underneath will suffer; hence it is very important that the apparatus should be easily removable, as is the case with a steel brace.

Dr. McKenzie had obtained just as good results with leather as with steel in the treatment of Pott's disease. He places a strip of harness-maker's felt on either side of the spine, so as to make pressure directly on the boss, and this, when used in conjunction with a leather corset, gives adequate support and very satisfactory results. Raw-hide can be even more perfectly adapted to such cases.

Dr. Weigel said that all the difficulty arising from the plaster mould absorbing the water from the cream could be avoided by first thoroughly wetting the plaster mould before pouring in the plaster cream. The great objection he had found to the raw-hide was the inevitable curling which occurred when it was worn.

Dr. McKenzie replied that he had found the same difficulty with light raw-hide, but not with the strong hide taken from along the back of the animal.

Dr. Steele, in closing the discussion, said that a cast which could be revolved in the manner described by one speaker would not be sufficiently strong to withstand the enormous pressure which he applied when wrapping the leather around the cast. Where the model is quite irregular he sometimes places small pieces of leather in such a way that the leather of the corset will be forced down into the depressions. He had tried hardening the leather in hot water, but had spoiled the leather. When it is necessary to place a tongue underneath the edges of the jacket, the best material to use is a strip of hair-cloth covered with chamois, as this does not wrinkle, and allows the edges to overlap.

JOINT LESIONS DUE TO DISEASE OF THE SPINAL CORD, WITH A REPORT OF TWO CASES.

By JOEL E. GOLDTHWAIT, M.D.,
BOSTON.

Spinal Arthropathy; Arthropathia Tabidorum; Charcot's Disease.

Joint diseases occurring in persons having some affection of the nerve centres, or of the large nerve trunks, have been recognized for a goodly number of years. From the resemblance of these joint lesions to those occurring in certain forms of rheumatism, they were for many years all classed together as rheumatoid arthritis, and because of this mixing of the pathological conditions due to disease of the nerve centres, and of those of purely a rheumatic nature, Dr. J. K. Mitchell, of Philadelphia, in 1831 was led to advance the theory that rheumatism was a spinal neurosis. This theory was more or less accepted; and not until 1868 were the joint lesions of a neurotic origin classified by themselves. At that time Charcot gave a lecture on the relation of these diseases to tabes dorsalis or locomotor ataxia, and from that time the disease has been most commonly known by his name. Some years later, Dr. Thomas Buzzard again called attention to the disease, and since that time it has attracted more or less attention from the various neurologists, and finds mention in nearly all of the works of surgery. To the orthopedist the subject is, of course, of considerable importance, particularly for differential diagnosis.

During the past year I have been fortunate enough to see two patients with this disease, and they are reported in detail for our study. Both were men; and the etiology in the two cases is entirely different: the first probably of specific origin, while the other was due to direct injury to the spinal cord.

Case I.—W. A. D., a man, fifty-three years of age; married, and a porter by occupation. He has a good family history, has been temperate in his habits, and denies ever having had any venereal disease. In 1885 he had the left great toe amputated for caries, which apparently began as a perforating ulcer. Aside from this he has been well; until the last few years, since which time he has been "running down;" has lost some flesh, and has been unable to do as much work as formerly. He has never had rheumatism, but recently has had indefinite pains in various parts of the body, and at times they have been shooting in character, starting in the upper part of the body and running down into the pelvis. There have been no other symptoms.

In the early part of March, 1891, while stooping to pick up some object, he felt a sudden sharp pain apparently in the right ankle, after which he was unable to bear his weight upon this foot. Previously there had been no lameness or swelling in any part of the body. He was obliged to lie down, and for a short time there was some pain on motion of the leg, with some swelling about the hip. The pain ceased entirely in a few days, and he was then transferred to the Boston City Hospital, where he was put to bed with weight-and-pulley extension to the leg. At this time his physical examination was something as follows: Pale and cachectic, fairly well developed, and poorly nourished. Heart regular and strong; lungs normal. The right leg straight, with foot moderately everted, and $1\frac{3}{4}$ inches shorter than the other (measured between the anterior superior spine of the ilium and the internal malleolus). There was some swelling and induration all about the hip, but neither condition was marked. There was no pain, tenderness, or ecchymosis. The striking feature was that the leg could be moved about in all directions without any limitation of motion, and the femur could be slipped up and down upon the ilium, allowing a play of three or four inches, without any pain. On this motion there was a marked grating very like crepitus. The trochanter rotated upon about the normal radius, as if the neck of the bone were intact. The acetabulum could not be felt; there was no slipping in or out on motion.

The sensation was diminished in the left leg, otherwise there

was nothing abnormal. The motion and outlines were as they should be.

The right pupil was smaller than the left—reaction not noted. The patellar reflexes were absent, while the cremasteric reflexes were present.

Nothing of interest occurred until about a month later, when he began to have occasional pains in the other hip, but nothing abnormal could be detected on careful examination.

In the latter part of May, 1891, he left the hospital, and since that time he has been wholly under my care. He was allowed crutches, and was urged to move about.

Three months later the left hip went through exactly the same condition as the other joint, except that there was absoluely no pain, and the patient was about all of the time.

At the present time he is in very fair general health, he sleeps well, and has a good appetite. He gets about very well with the aid of crutches, and by holding on to the balustrade he can go up stairs nearly as fast as a person in health would walk. He is entirely free from physical pain. The attitude in standing is very well shown in the drawings: marked lordosis, hips prominent, and legs apart for support. On walking, the body is swung to one side, and the leg, which lengthens when the weight is off, is thrown forward, apparently by the psoas and iliacus muscles. There is marked toe-drop.

Both hips are freely movable on passive motion, and besides the normal motions there is the up-and-down play of two or three inches. The acetabulum cannot be made out on either side. The marked grating is still felt, and on both sides. There is considerable thickening about both great trochanters, which is apparently bony, and there is also considerable thickening on the inner surface of the ilium, which can be felt by the rectum. There is no redness or induration of the superficial soft parts, no muscular spasm, and no tenderness on pressure. There is one small irregular cicatrix above the internal malleolus, otherwise none. There are no nodes on the long bones.

The sensation in both legs is equal and practically normal. The knee-jerks are absent. The cremasteric reflex is present on the left side, but absent on the right. There is no ankle clonus. The

pupils are unequal, and react slightly to accommodation, but not at all to light. There is incontinence of the urine, and the bowels are very sluggish. The sexual power is absent.

Fig. 1.

Case II.—A. B., a man, thirty-five years of age; married, and a cabinet-maker by occupation. He had always been well until October of 1888, when he fell a distance of fifteen feet, striking upon a plank, and producing a fracture of the spine in the lower dorsal region. At this time he was almost completely paralyzed below the fracture, with retention of urine. The sensation was normal, until two days after the accident, when it entirely disappeared from the whole left leg to above the hip, and the next day the right foot was somewhat numb. The sensation returned in a few days, except upon the left side, particularly about the hip. After the accident he was in bed for eight months, and then was allowed to be about on crutches.

In the fall of 1890, while walking, the left leg gave way, and he was unable to bear his weight upon it. He was taken to the Boston City Hospital, and although examined several times under ether, by the various surgeons, no sign of fracture could be made out, and nothing definite could be determined as to the condition of the hip. There was no shortening. The sensation in the leg was impaired.

After remaining in bed for about three months he left the hospital, and began to use crutches again. During this time his leg grew shorter. There was absolutely no pain.

The patient was first seen by me in February of 1891, and he then presented the following condition: In fairly good general health. He walks with difficulty, even with the use of a cane. The extensors of the foot and thigh having lost much of their normal function, the leg is thrown along largely by the psoas and iliacus muscles. On standing, the knees are braced against each other and the right leg—the longer—is slightly flexed. He is obliged to steady himself with a cane. There is moderate lordosis, and there is a long spinal curve to the left in the dorso-lumbar region (evidently due to the short leg). There is a kyphosis involving the tenth, eleventh, and twelfth dorsal spines. The left leg is $2\frac{3}{8}$ inches shorter than the right, and is $\frac{1}{2}$ inch smaller. Abduction and adduction are slightly limited, and inward rotation is restricted about one-half. There is very little up-and-down motion. There is incontinence of urine, and the bowels are very sluggish. The knee-jerk upon the left side is lost, while it

is normal upon the right. There is no ankle clonus, and the pupillary reflexes are normal. There is a deep circular ulcer in

Fig. 2.

the centre of the right heel about the size of a nickel, with sharp edges.

Since the first examination, one and a quarter years ago, there has been very little change in his condition, except that by the use of a swathe about the hips, and a high sole on the short leg, he is able to walk a little better. A similar ulcer to the one upon the right side has formed upon the left heel.

The exact etiology of these cases is by no means settled, different writers having decidedly different opinions, and some even deny the existence of such a disease. To quote from Howard Marsh: "This affection of the joints, both in its symptoms and its morbid anatomy, bears, as already said, so close a resemblance to osteo-arthritis that many observers maintain that they are one and the same disease."

To discuss the pros and cons of this question would take far too much time, nor do I think it necessary, as I feel sure that you all agree that the disease under consideration has a clinical history and a morbid anatomy which is peculiar to itself.

That which is considered to be the common cause of such joint lesions, *i. e.*, tabes dorsalis, is undoubtedly present in the first case; the shooting pains, the Argyle-Robertson pupil, the unsteady gait, and absent knee reflexes all point to locomotor ataxia.

The second case, having for its cause a fracture of the spine, is, so far as I am aware, the first case that is recorded, with this etiology. Just what the nature of the injury to the cord was, is, of course, uncertain. It is probable, however, that it was either torn across, or that it was bruised and pressed upon enough to cause the paraplegia. The sensory nerves were not affected until the second day, when the sensation disappeared from the left leg—the same side on which the joint disease occurred. Furthermore, the sensation was never wholly restored, showing that there must have been some permanent injury to these fibres. It is reasonable to suppose that the trophic nerves were injured at the same time.

Other causes are mentioned by various writers until nearly all of the diseases of the spinal cord are included. Sir James Paget[1]

[1] Clinical Soc. Trans., vol. xviii. p. 69.

cautiously considers the disease due to an admixture of several morbid conditions, notably gout, rheumatism, and syphilis. Billroth[1] thinks the conditions always due to hereditary syphilis. Strümpell[2] considers the condition not wholly "nervous trophic," but partly due to traumatism to the joint. Vigues and Joffroy mention an acute form occurring in Pott's disease. Michaud[3] reports the same condition. Gull has seen it in idiopathic myelitis. Ross[4] adds progressive muscular atrophy and disseminated sclerosis, as well as hemiplegia. Lovett[5] mentions syringo-myelia. In fact, any disease which produces an atrophy of the large ganglion cells of the anterior cornua of the cord is supposed to predispose to this joint disorganization. It must be admitted, however, to offset this opinion that Joffroy has examined three cases, and Coyne one, in which no such atrophy was present, which helps to support Buzzard's theory that the disease is wholly due to some lesion in the medulla.

Pathologically these two cases are of interest in a negative way by showing so little before the joint was destroyed. The bony thickening and induration, which is spoken of as being seen in the beginning of the disease, was not present. The first case was examined carefully at the time the right hip gave out, and there was little, if any, bony thickening to be made out on that side; while the other hip, which three months later became destroyed, appeared at that time as a normal joint.

In the second case, when first examined, there was no thickening to be made out, and it is only recently, or over a year from the time of the joint disorganization, that it has been marked. This is contrary to what has been written upon the subject, from which we are led to expect bony overgrowths and marked trochanteric thickening very early in the disease, a condition that is directly opposite to that which was present in these cases. This point seems to me to have some importance, especially in the differential diagnosis between spinal arthropathy and ordinary osteo-arthritis, in

[1] Lect. XL., Surg. Path.
[2] Text-book on Med.
[3] Sur la Méningite et la Myélite dans le Mal. Vertébral, p. 54.
[4] Diseases of the Nervous System, vol. i. p. 223.
[5] Diseases of the Hip, p. 168.

which latter disease one finds this thickening early, and the joint destruction, which is less liable to occur, as a later symptom.

There is, of course, an acute form of spinal arthropathy, which is seen in pressure myelitis, from Pott's disease, or idiopathic myelitis, in which the pathology is different. In this there is considerable pain, with tumefaction and joint effusion. It is apt to go on to suppuration, and presents an entirely different condition for prognosis as well as for treatment, from the chronic form which is more often seen.

An early diagnosis must be difficult at all times. The course of the disease is so insidious that it is not, as a rule, until the bones have become displaced that the trouble is noticed. This is very well shown in the first case, where the patient was under careful observation for six months before the left hip slipped out, without the suspicion of trouble being present. It would have been more easy to have predicted some joint trouble in the second case, from the undoubted injury of the nerves or nerve cells having to do with sensation and motion of the affected leg, but which joint would be attacked could have been nothing more than guesswork. The absence of pain, or at least the slight character of it, makes it easy to understand why the patient's attention is not attracted to the joint until some obstacle to locomotion is offered. Even at this time the diagnosis may be troublesome, the condition being most often confounded with a simple dislocation or a fracture at the neck of the femur. The absence of pain, however, together with the absence of muscular spasm, the characteristic dry rub, or grate on motion, and the presence of some spinal disease should make the diagnosis clear.

The treatment should, of course, aim first at controlling the disease in the cord, whether in the acute or chronic forms. If the acute type with joint effusion, rest in bed, with extension to prevent dislocation, and incision of the abscess, if one forms, is briefly all that is required.

In the chronic form, after the joint has been destroyed, the treatment is at best unsatisfactory, and to make locomotion as easy as possible is the aim. Excision is advised with the disease located in the knee, but it is obvious that this would be useless with the same condition at the hip. One of my cases has been helped a great

deal in walking by wearing a belt fastened tightly about the hips. It seems to steady him and give the muscles something to work against. Massage, of course, is of value to keep up the nutrition of the muscles, and possibly electricity would be of benefit.

In the way of direct medication, both of the cases were improved by taking nux vomica for a considerable length of time. Otherwise, drugs have had no effect.

DOUBLE CLUB-HAND AND DOUBLE CLUB-FOOT.

By WILLIAM J. TAYLOR, M.D.,
PHILADELPHIA.

Willy M., aged twelve years, applied for admission to the wards of the Orthopedic Hospital in the autumn of last year, with the rare combination of deformities—double club-hand and double club-foot. He was small for his age, rather deficient mentally, and without education or training. His mother, an ignorant Irishwoman, said there was no history of deformity among the other members of her family, and that the condition here presented existed at birth.

This photograph, very kindly taken for me by Dr. Cordier, of Kansas, shortly after the boy's admission into the hospital, shows very accurately the deformity. Both hands were clubbed; the metacarpal bones were flexed upon the carpal, the thumbs were drawn into the palms of the hands, and the fingers could not be extended, but there was some limited range of movements.

When force was applied to extend the metacarpal bones the fingers would curve into the palms of the hand; it was thus impossible to straighten the fingers and the hand at the same time.

The movements of the fingers were limited, and in grasping an object the metacarpo-phalangeal articulation of the thumb was pressed against the first phalanx of the index finger.

On the dorsal surface of each wrist was an enlarged bursa and much hardened skin. There was no deficiency or arrested development of the bones of the forearm or hand. The condition was typical of paralytic club-hand.

Both feet were deformed. The left one imperfectly developed, much shortened, and in an extreme degree of talipes equino-varus. There was no motion in the tibio-tarsal and middle-tarsal articulations. On the outer side of the foot, upon which he walked, was

an enlarged bursa and much thickened skin. The muscles of the leg were markedly atrophied.

The right foot was in a condition of talipes valgus, with marked prominence of the scaphoid bone, but normal in size and develop-

Fig. 1.

ment. The flexors of the foot were much contracted, while the metatarsal and the tibio-tarsal articulations were immovable. The muscles of the leg were also much atrophied. In walking, his gait was most peculiar and awkward, although he could move with considerable rapidity.

The hands were manipulated persistently, and several times he

was placed under the influence of ether and the fingers and hands forcibly extended. Very little or no improvement in the degree of deformity was noticed as a result of these measures, but there was a marked gain in the range of movements of the fingers and in his ability to use the hands. This improvement was so marked that before he left the hospital he could cut out paper dolls very neatly with a pair of scissors.

Tenotomy, to overcome the contraction of the flexor tendons, was considered, but operative measures were decided against, because he could use his hands with some accuracy, and in the fear that when the tendons were cut and the fingers straightened their usefulness might be lessened.

In October I operated upon the left foot, after the most careful disinfection and with strict antiseptic precautions. An incision was made over the prominence of the astragalus, which was much altered in shape and position, and the attempt made to remove it. From its malposition and the dense fibrous thickening about the tibio-tarsal articulation, this was found to be impossible, and a chisel was then used to cut it away, bit by bit, and with it the cuboid and the heads of the three outer metatarsal bones. In reality, a V-shaped tarsectomy was done. An accurate description of the bones removed was impossible.

The tendo Achillis was then cut, and by the application of considerable force the foot was brought into a fairly good position. The wound was then sutured without drainage, and a plaster-of Paris splint applied. I regret now that I did not remove more of the bone, for the ultimate result was only fairly good. At the time, however, so much had been cut away that I hesitated to take more.

The boy took ether very badly, and I therefore deferred operation upon the other foot until a later date. When he was again etherized some weeks after the first operation, from which he made a complete recovery, I endeavored to overcome the valgus of the right foot by tenotomy of all the flexor tendons and forced extension of the foot, but without improvement. I therefore made an incision on the inner side of the foot over the scaphoid, and removed a wedge-shaped mass of bone by means of a chisel. Here, again, it was impossible to determine the anatomical relationship of the bone cut through. By this means the deformity was readily overcome and the foot

straightened. The wound was sutured without drainage and a plaster-of-Paris splint applied.

He made a complete recovery from both operations. There was marked improvement in the deformity of both feet, although the result of the operation in the left foot was not so good as I could wish, or would have been, had I removed a greater amount of bone. He was able to wear an ordinary pair of shoes, and in walking his gait was wonderfully improved.

In looking over the records of the cases which have been treated at our clinics in this hospital I can find only one similar case of this quadruple deformity, and that among some seven hundred and fifty-five cases of club-foot. A cut of this case has been published by Dr. Agnew (*Principles and Practice of Surgery*, vol. iii. p. 368). In this instance both feet were in a condition of varus.

Club-hand would seem to be a rare condition, especially the paralytic, spastic variety, such as is here presented. Writers upon the subject of deformities in their systematic works devote little or no space to this subject, and generally dismiss it with a few words. Club-hand, in which there is a deficiency of one or both bones of the forearm, usually the radius, is more common. I have seen at least four cases of this latter deformity—the last one a baby only a few weeks old. Here both radii were so imperfectly developed, while the ulnæ were normal in size, that the hands were at a right angle to the axis of the forearm. This child had also a supernumerary thumb on each hand.

Mr. Frederick R. Fisher ("Orthopedic Surgery; Treatment of Deformities," *International Encyclopœdia of Surgery*, vol. iii. p. 659) states that of three thousand cases of deformity which have come under his own personal observation, there were only forty-two cases in all of deformity of the upper extremity.

Mr. Holmes Coote (Abstract, *Proceedings of the Royal Medical and Chirurgical Society*, 1858–61, iii. p. 141) describes a similar case in an infant; and M. Budin (*Bull. Soc. Anat. de Paris*, 1872, xlvii. p. 593) describes this condition in an infant who lived only half an hour after its birth. Dr. H. Augustus Wilson reports a similar case, and publishes an illustration of it (*Annals of Gynecology and Pœdiatry*, June, 1891). Both feet in these cases were in equino-varus.

R. W. Parker (*Congenital Club-foot*, 1887, p. 47) speaks of this condition as one of extreme rarity, apart from a deficiency of the bones of the forearms, and gives an account of a case of double club-hand and double equino-varus.

These few cases of double club-hand and double club-foot are all that I can find accurately described, although I have gone carefully through a great number of reported cases.

Treatment at best gives most unsatisfactory results. Forced extension of the hands and wrist while the boy was under the influence of ether was tried repeatedly. Splints were applied in the hope that continuous traction would overcome the deformity, but with little or no benefit. Persistent and daily manipulation by a skilled masseur gave the best results, and these were slight. For reasons already given, tenotomy was not attempted; but since the boy passed from under my observation I have regretted that I did not make the attempt to lengthen the contracted flexor tendons, after the methods of Dr. Keen or Mr. Anderson. In this way a definite increase in length would have been gained without the same danger of over-correction of the deformity, and a consequent loss of the control over the movements of the fingers which he already possessed.

I feel sure that had this boy come under observation a number of years ago, when he was an infant, much good might have been accomplished, and most, if not quite all, of the deformity overcome. At twelve years of age, and the comparatively short time in which he could be kept in the hospital and under strict control, made the result at best very imperfect.

MY ASSISTANT IN THE TREATMENT OF BONE TUBERCULOSIS.

By J. D. GRIFFITH, M.D.,
KANSAS CITY, MO.

What a desideratum it would be could we in the practice of surgery, particularly of orthopedic surgery, have some internal remedy approaching a specific in our cases of tuberculosis to go hand-in-hand with operative treatment, and especially would such a remedy be exceedingly valuable where operative interference might not be desirable. The experience of the present writer tends to show that we have such a means to this end.

Under the head of *Creasotum*, Greggor Smith speaks of guaiacolum as a colorless, highly inflammable liquid, and says it is the most active ingredient of creasote, of a very much less disagreeable odor, soluble in alcohol, not soluble in water, mixable with glycerin. He gives it internally in doses of from one-half to fifteen drops three times per day in gelatin capsules, pills, or alcoholic solution. He seems to fear the action of light, as he always speaks of its being kept in covered or colored bottles. We have noted a change in the color and the effect of the drug when not kept in colored bottles, or when exposed to the light. It becomes dark in appearance and loses its peculiar odor, and becomes irritating when administered, not producing vomiting, but interfering with the appetite and causing a form of diarrhœa closely resembling enterocolitis. Atfield says wood-tar furnishes guaiacol. It is also a product of the destructive distillation of guaiac resin.

In 1878 and 1879 Max Schueller found, by experiments made with benzoate of soda, creasote, and guaiacol, that they all checked the development of microörganisms in culture from tubercular tissues taken from diseased joints, as well as lungs. Hence, the conclusion that they might have some effect in preventing the

development, if not causing the destruction, of microörganisms in living tissues. He found by giving inhalations and injections of guaiacol in cases of inoculated tuberculosis of joints, that, as a rule, the animals so treated increased in weight and the general trouble subsided, while control animals developed widespread local and general tuberculosis. In all animals that were killed after being treated for periods up to eight and one-half months, not only macroscopically but microscopically, evidences of healing in various joints were noted. Such, for instance, as retrograde metamorphoses, absorption and incapsulation of caseous masses, and cirrhosis of the joint capsule; also, sclerosis of the spongy bone around foci of softening.

In lung tissues examined, he speaks of and describes an ordinary process of healing taking place instead of progress of the tuberculosis. The least effective of the materials tried was the benzoate of soda. On the other hand, the guaiacol was the best and most thorough. For inhalations, he generally used weak solutions, one to six hundreth part of distilled water. This he speaks of as being particularly useful in scrofulous ozæna. Guaiacol should generally be used internally in liquid form. During the past two years I have exhibited pure guaiacol four to five times a day in doses of from two to five drops on a lump of sugar, in sweetened water, in milk, and in beer. If it cannot be used internally it can be administered in solution per rectum, or subcutaneously when mixed with pure sterilized glycerin. In order to be effective, the use of guaiacol should be continued for a period of eight weeks to a year and a half. It is well borne by the stomach for this length of time, and is eagerly taken by children. Within from twenty-four to thirty-six hours after commencing the use of this drug its peculiar odor is observed, markedly, in the perspiration, on the underwear, on the breath, and gives to the urine and feces a very peculiar smell. Schueller speaks of the frequent failure, or unsatisfactory result, from a purely surgical treatment of tubercular joints. He always, in all cases, combines the guaiacol treatment with the local, continuing this general treatment for months, even after the local treatment has seemingly succeeded. The benzoate of soda seemed, in children with tubercular glands (not broken down or widespread),

to have good effects, while in joint affections the drug proved absolutely useless. His expectations from guaiacol were great, because he found that even in very attenuated solutions it completely destroyed the infectiousness of cultivations made from tubercular tissues.

SCHUELLER'S STATISTICS.

Tuberculosis.	Number of cases.	Cured.	Improved.	Died.	Lost sight of.
Of skin and mucous membranes . .	5	5			
" glands not operated on	12	11	1		
" " " " "	11	10	...	1	
" muscles	1	1			
" testicle	2	2			
" bones, joint amputation . . .	2	2			
Incision, curetting, ortheotomy, resection	14	11	2	1	
Iodoform injection	15	12	2	..	1
Joints of extremities	28	12	8	2	6
Spinal column	10	4	3	...	3
	100	70	16	4	10

Only three died under treatment, as follows: One child after extirpation of tuberculous axillary glands—of meningeal tuberculosis; and one child after hip-joint resection—of meningeal tuberculosis. In both of these cases the operation wound was doing well. One child died while being treated for tubercular gonitis, the cause of death being diarrhœa, which had nothing to do with the knee trouble. One child died of phthisis three years after the cure of the tubercular coxitis. During these three years it was not under Schueller's care. Under the head "improved" are several cases once more under treatment, as the improved case after iodoform injection, four of which were "not operated on" and one "neither operated on nor injected;" these cases have returned for treatment. The few remaining cases are such as were observed during a long period to be more or less improved, but who, later, were lost sight of. Under heading "lost sight of" are a few cases in which treatment was ordered or begun, but only carried out for

a short time, or from whom no subsequent history could be obtained. Under the heading cured are the following:

Cure (treatment persisted in)				.	.	.	1	former	patient	for	10	years.
"	"	"	"	.	.	.	2	"	"	"	8	"
"	"	"	"	.	.	.	17	"	"	"	7	"
"	"	"	"	.	.	.	1	"	"	"	6	"
"	"	"	"	.	.	.	3	"	"	"	5	"
"	"	"	"	.	.	.	2	"	"	"	4	"
"	"	"	"	.	.	.	4	"	"	"	3	"
"	"	"	"	.	.	.	2	"	"	"	2¼	"
"	"	"	"	.	.	.	16	"	"	"	2	"
"	"	"	"	.	.	.	2	"	"	"	1¾	"
"	"	"	"	.	.	.	11	"	"	"	1	year.
"	"	"	"	.	.	.	1	"	"	"	7	months.
"	"	"	"	.	.	.	3	"	"	"	2	"
"	"	"	"	.	.	.	5	"	"	"	1	month.

One patient is known to have been cured but *recently*. No information about him could be obtained. He is one of the oldest cases—about ten years.

During the past two years we have used Merck's guaiacol in forty-one cases of tubercular joint trouble, and in no case (uncomplicated with cavities in the lungs) where the drug has been continued for six weeks have we yet failed to see an increase in weight in the patient and a diminution in joint symptoms. That other therapeutic agents are frequently necessary there is no doubt. Iron, especially the old wine of iron (tartar of iron, and potash), seem to add to the efficacy of the drug. In children, especially in hip and spinal tubercular diseases, given in milk or sweetened water, the guaiacol seems to exert a most remarkable influence, and it is surprising how soon one can give a large dose (for the age) without in the least upsetting digestion or irritating the intestinal tube.

In Pott's disease, attended with abscess (thirteen cases now under treatment) we have found most rapid improvement when our ordinary treatment was combined with guaiacol. Again, in that, the most dreaded disease of all the tuberculous bone and joint troubles, viz., those of the ilium and sacro-iliac synchondrosis with sinuses, we have used it in two cases, and both of them are still under observation. They have improved markedly.

In no case would we discontinue the use of guaiacol internally for several months after the symptoms of bone trouble have disappeared. Dr. J. F. Binnie, of Kansas City, has also noticed in his

cases (several in number) the same increase in weight and general condition, most marked by improvement in appetite.

We have used the guaiacol by injection parenchymatously (1 : 500) in two cases of gonitis, after the method of N. Senn with iodoform, and obtained just as good results. In three cases, one knee, one elbow, and one wrist, we have used the same injection intracapsularly, accompanied with fixation; the elbow and wrist recovered with perfect mobility. The knee is still under treatment.

We have used the guaiacol, pure, as an application in tuberculous cavities, in the tibia, two; in the tarsus, three; in the elbow, one; (in the shoulder-joint, two, diluted 1 : 100). The patients have complained of a burning sensation after the application has been made, this burning sensation lasting for but a few minutes. Such tuberculous cavities thus treated almost at once take on healthy action. These applications were made either with the syringe or by stuffing the cavities with gauze saturated with pure guaiacol.

After the apparent cure of a local tubercular lesion, treated surgically, we use guaiacol for from five to eight months, especially do we do this if there is any pulmonary disease. In cases where long-continued treatment is necessary, and in cases in which the stomach or intestines are irritable, we can make the lungs absorb immense quantities of guaiacol by administering inhalations of atomized water solution, best given in a large chamber. The strength of this water solution is three to five thousand.

Conclusion 1. Guaiacol where used locally, or internally, is a powerful antiseptic in tuberculosis.

2. Tuberculous patients, to whom guaiacol is given internally, show marked increase in weight, strength, and appetite, if the use of the drug is continued long enough.

3. The exhibition of guaiacol in joint or bone tuberculosis should be continued through a long period of time.

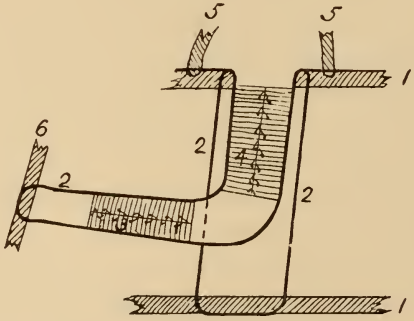
4. Guaiacol, unlike its close relation, creasote, is non-irritating to the stomach and is well borne for a long period.

Lastly, guaiacol is a great aid to the surgeon in the treatment of all forms of tuberculosis of joints or bone. Hence, why not shorten the disease!

A NEW FIXATION SPLINT.

By HALSTED MYERS, M.D.,
NEW YORK.

Dr. Halsted Myers presented a wire elbow splint for cases requiring immobilization. The thoracic attachment was especially serviceable in children where the arm and forearm were short. The splint allowed easy access to the joint; was not at all conspicuous, since the coat-sleeve was drawn over it; was easily adjusted to any position by simply bending the wires at the elbow-joint; was durable, and could be made readily by the surgeon himself if necessary.



1. Thoracic and pelvic belts to hold splint firmly to body.
2. Wire frame of splint (No. 5 Stub's gauge, for children under ten years of age).
3. Forearm sleeve (leather).
4. Arm sleeve (leather).
5. Shoulder strap.
6. Strap holding metacarpal bones immovable.

ORTHOPEDICS FOR THE POOR.

By JOHN C. SCHAPPS, M.D.,
BROOKLYN, N. Y.

Orthopedic surgery is peculiar in the following respects:

1. It is preëminently the surgery of the poor. The element of malnutrition, dependent upon lack of hygiene in our crowded cities, underlies a very great proportion of the conditions we are called upon to relieve.

2. It is slow surgery. While the time of the treatment of almost any other surgical case may be measured in days, weeks, or perhaps months, that of an orthopedic case usually requires years.

3. It is the surgery of minutiæ. The natural tendency of orthopedic as compared with other lesions is away from recovery. So much greater is the burden laid upon the surgeon, and to so much greater degree do his measures determine the result.

In view, then, of the fact that the care of these cases involves the closest possible attention to details for periods of years, and that the patients are generally young and helpless and in charge of the poor and ignorant, it is evident that an orthopedic service must differ radically from any other. Provision must be made, not merely to relieve some acute phase of a chronic process, which is all that is usually attempted by a general hospital, but to carry the patient through a long illness and meet its varying demands. Some cases are best treated at a dispensary. Others will do better at home. Others need operative measures or a constant supervision only to be obtained in a hospital. The same patient may at different times require dispensary, home, and hospital care. An orthopedic service that does not provide for all these needs is incomplete.

About three years ago, St. Mary's General Hospital in Brooklyn, which had previously afforded only hospital treatment, undertook

to meet more fully the orthopedic needs of the city by a service which, though modest in its appointments, should be complete in its scope. As is usual in charitable institutions, the most rigid economy was necessary, and our beginning may be instructive as illustrating how little will suffice for a start. We adopted many of the business methods which had been used for years at the New York Orthopedic Dispensary Hospital and the Hospital for Ruptured and Crippled in that city. The dispensary was to be the principal feature, and the hospital care and service at patients' homes were only adjuncts.

For recording cases, a book containing on the pages to the left a printed form is used. The following are the points upon which information is obtained: Family history, maternal and paternal; brothers and sisters living, their ages and health; brothers and sisters dead, their ages at death and causes of death; patient's personal history, condition in infancy, previous illnesses (especially exanthemata); supposed cause of present illness, duration, first symptoms, subsequent course and treatment; present illness, general and local; diagnosis. The remainder of the page and the whole of the opposite page are blank for notes of the case. The rule is to make some entry every time the case is seen. For examination we have the usual padded tables, screens, and means of suspension. To make outlines, as records and for the shaping of apparatus, the familiar strip of block-tin and press-board are used. Of the latter, what is known as No. 110 is a convenient thickness. A few quires of heavy, smooth manilla paper (40 x 48 inches, 125 pounds) are kept at hand for large tracings and patterns. A stout shears, tape-measure, red and blue pencils, cards for the patients, and manilla order-blanks complete our outfit for examining and recording cases.

The service is for the poor exclusively. In doubtful cases, a note from a clergyman, physician, or some other reliable source, stating that the patient is unable to pay for treatment, is required. It is expected that, so far as they can, patients shall pay for the use of the apparatus; and for this purpose a fixed price, to be paid at once or by instalments, was put on each instrument. The result was that some, having secured braces, would, in spite of printed and verbal notice to the contrary, regard them as their own. Then, with characteristic faith in the intrinsic potency of the instruments,

they would dispense with further attention. Accordingly, the plan of charging a rental of fifty cents per month for each patient wearing a brace was adopted. An account is kept on the back of the patient's card as well as in the ledger. When satisfactory evidence is furnished that this expense could not be met, the brace is furnished free. Of course, we fail to collect a considerable share that was charged, but what we do collect serves to pay about one-third of our instrument account.

In the use of apparatus, one working principle adopted was that a brace is simply a tool in the hands of a workman. Patients were not to be sent to an instrument maker for therapeutics, but the pathological changes and the resulting mechanical conditions having been determined, the function of the surgeon was not considered as completed. It is the skill and perseverance with which one meets these conditions by mechanical means personally applied, and varied from time according to the peculiarities of the case, that constitute the distinctive claim to be considered an orthopedist. The details of mechanical therapeutics are as important as difficult and as interesting as are those of the morbid conditions to be antagonized. An orthopedic surgeon must be a mechanic. Though, to save his time, he leaves much to be done by a workman, he must be able to dictate the smallest detail of an instrument. One soon learns that the time spent in acquiring personal familiarity with the use of tools and the properties of various qualities of steel, leather, buckles, webbing, etc., has been employed in getting an essential part of an orthopedic education.

Another and no less important principle is that *an instrument to be efficient should give relief. When an apparatus is a source of pain or discomfort, it is not only not doing good but is probably doing harm.*

In all cases, but especially those applying at a dispensary, simplicity of apparatus is very desirable. We avoided the use of rack and pinion, ball-and-socket joints, and snap catches, and reduced the number of movable joints to a minimum. The simple splint used at the Polyclinic and Hospital for Ruptured and Crippled has been our model for hip cases. It is a very satisfactory machine for the purpose; needs little or no repair, and when a patient outgrows it we apply another, and have the old one re-upholstered for another

patient. When traction is no longer needed the brace is used simply as a perineal crutch. The adhesive plaster which has given the most satisfaction is Shiver's, spread on twilled muslin. It is comparatively unirritating and strong enough for any case. The buckles are riveted on, and the plaster is applied many-tailed style. The leg is rarely washed, except over the knee, which the plaster does not cover. In other situations the loose epidermis and accumulated secretions, constituting the "dirt," come off with the plaster. By keeping the skin dry I believe we avoid the eczema sometimes so troublesome. We have only once had to leave off traction on that account.

For bandage material, as the dressings are to remain undisturbed for weeks at a time while the patient is ambulatory, a very firm muslin is desirable. We prefer the brand known as unbleached cast iron. The bandage is stitched edge to edge down the front of the limb. To prevent soreness from instrumental pressure, the parts should be bathed daily with alcohol and water and dusted with Fuller's earth or carbolated talcum. These precautions are quite necessary for the perineum and groin in hip cases, and the kyphoses in spinal diseases. As an additional protection to the former, where strong traction is necessary and the skin is delicate, a pad consisting of two pieces of sheet lint separated by a thin layer of cotton wadding is very efficient. The wadding takes up the friction that would come on the skin. For a dressing for abscesses a pad of oakum is sandwiched between layers of sheet lint or muslin, and a hole is cut in the centre of the one to be placed over the sinus. One layer of muslin protects the skin, the other the clothing. The Thomas knee splint is used to afford protection to the knee and ankle, with the addition of special fixation means when necessary. For the knee we use the posterior steel support used by Dr. Judson, or plaster-of-Paris, and for the ankle a brace consisting of sole plate and calf plate connected by a posterior bar. The Billroth sector splints are of the greatest service in overcoming flexion with subluxation in osteitis of the knee. In club-foot we do not hesitate to tenotomize when the resistance is not readily overcome by manual force, and generally apply plaster-of-Paris. When the resistance is mainly antero-posterior the plaster is reinforced by steel, so that the patient can walk on it. (See *Brooklyn Medical Journal*, Novem-

ber, 1891.) Later we frequently use the walking brace described in a recent number of the *New York Medical Record* by Dr. Judson. The Taylor brace, without hinge and with high apron, hard rubber pads and U-shaped hip band, is our usual means of treating Pott's disease. For head support we employ the Taylor head-piece with a detachable chin cup of hard rubber and occipital uprights, to which is fastened a frontal band of webbing. As the case improves the chin cup is removed and the frontal leverage maintained. The head-piece is connected with the spinal part by a slide and pivot of soft steel that may be bent to a required angle. For lateral curvature we put our trust in exercise, active and passive, and suspension. For the support of flat feet we have the following simple and efficient method: We had cast a pair of iron dies, between which are struck up on rectangular pieces of No. 18 or No. 20 sheet steel, the shape of a normal adult sole. We keep on hand a number of these pieces large enough for any ordinary foot. One is placed under the foot to be supported, and the outline scratched on the steel. After being cut to the required shape little or no alteration with the hammer is required. From this one pair of dies we can thus supply soles for large feet or small, right or left. In cases of bow-legs, if the curve is slight and the patient young, we build up the shoes on the outside. As a more efficient procedure, the braces of Dr. Knight are used, and are very efficient. For knock-knee we build up the shoes on the inside or use a brace of lateral bars without a joint at the knee.

As a matter of economy, we made arrangements with an instrument maker to have the greater part of the steel work done in his shop, and a man sent on clinic days to make repairs and to fill such orders as did not require forge or power. For this purpose the following outfit was provided:

Work-bench.
Speed lathe for foot-power.
Two chucks.
Parallel swivel vise.
Twenty-pound bench anvil.
Heavy bench shears.
Hall's cutting pliers, seven inches.
Pair strong cutting pliers, nine inches.

Stub's hand vise, four inches.
Screw-drivers, large and small.
Stub's broaches Nos. 25 and 35.
Sheet metal gauge.
Files; Twelve-inch bastard, twelve-inch smooth, eight-inch flat smooth, nine-inch half-round bastard, four-inch round smooth.
Three rivet sets.
Centre punch.
Solid punch.
Oil-can and oil.
No. 1 ball Peine hammer.
No. 1 riveting hammer.
One dozen twist drills.
Half gross machine screws, small.
Half gross machine screws, large.
Taps, large and small.
Pair three-inch snips.
Cold chisels, one-half and three-quarter inch.
Six-inch caliper.
Steel square, one foot.
Pair compasses.
Shoe knife.
Copper rivets and burrs: No. 13 one-quarter, one-half, five-eighth inch; No. 10 one-half inch; No. 9 three-quarters and one inch.
Iron rivets, various sizes.
Arkansas oil-stone.
Seven-inch hacksaw and one dozen blades.
Caliper rule.
Three tin gem pans for holding rivets, screws, etc.
Wood screws, No. 8, one-half and five-eighth inch.
Two pairs hooks for bending steel.
Acme wrench, eight inches.
Iron last on standard with three feet.

We added a few tools from time to time as our needs developed. The lathe was used almost exclusively for drilling, and almost any strong, small lathe will do. The broaches are handy little tools for

enlarging a hole. One size of screw is used for almost all purposes. It is midway between No. 6 and No. 7, and has thirty-six threads to the inch. It is employed very generally by instrument makers. Dugro, of Elizabeth Street, New York, makes them of very tough steel. No. 13 is a convenient size of copper rivet for most purposes. The drills were selected to match the screws and rivets. We had also a few bars of steel and some in sheet. The steel is a very weighty matter. It must be soft and tough enough to permit bending, and hard enough to keep a given shape and retain a thread. Bessemer steel will do for many purposes, but is too soft for others, and it is not easily obtained in small sizes. Spring-steel, not too high grade, does very well. What is known as a 60 to 80 carbon is an ideal steel. Tool steel is too hard.

Since the establishment of the service our work has steadily grown, and it has now become advisable to make provision for the manufacture of all our apparatus. Our new equipment comprises a boiler, five horse-power engine, a good engine-lathe, a drill chuck, a four-jaw independent chuck, forge, grindstone for power, polishing lathe, with two emery wheels; standards, with polishing wheels and buffs; large anvil, blacksmith's tools, taps, dies, and in fact, a fairly complete machine shop. The lathe and forge are arranged for foot power as well as steam, so that odd jobs may be done at any time without delay.

Any brace that requires fitting is tried on and altered as many times as necessary before the padding or leather work is done. The latter we undertook ourselves, and the operators had to learn as they went. Dr. Gibney kindly afforded us every facility for getting the practical details of the work at the Hospital for the Ruptured and Crippled. For padding, covering, making of perineal straps, and other sewing, we have a heavy and a light sewing machine arranged for leather, cutting board, saddlers' knives, punches, awls, and a very convenient little machine for setting hooks for lacings. Buckles and webbing are matters of moment. After some mistakes, we settled upon what is known as a square bar solid buckle and $\frac{7}{8}$-inch extra heavy suspensory webbing for general use. A $\frac{3}{4}$-inch light linen and light brass buckles are also necessary. The leather employed for lining is a heavy alum-tanned lambskin, and that for outside covering a good quality of russet cowhide rendered pliable

by a process known as boarding. Straps of stout bridle leather, with buckles to fit and cut soles, are kept in stock for the hip-splints. Machine silk, D or E, and heavy linen thread are used for sewing. For padding, waste pieces of kersey from a horse-blanket factory serve admirably. We are gradually learning to dispense with padding. We keep on hand a number of hard rubber plates, misnamed pads, with which to face those parts of the spinal brace that press upon the kyphos. They do not absorb the decomposing secretions of the skin as the soft pads do, and thus are not so liable to produce sore backs.

Hospital care, though only a feature, is a very important one in an orthopedic service. Though the time for which it is needed is usually very short as compared with the duration of the disease, it is a time in which a great deal may be accomplished. Patients are usually admitted for treatment by recumbency, with or without traction, during the acute stage of some bone or joint disease; or while awaiting the preparation or repair of a brace; or because they cannot get proper care at home; or for operation. Orthopedic cases in a general hospital when brought into competition for the time and care of the busy house staff with the more brilliant cases of acute surgery are sure to suffer. Even the frequent change of internes is a great disadvantage. An assistant with orthopedic tastes and training is a necessity. In treating patients by recumbency, one is impressed by the way patients thrive under it, even in a hospital ward. It is quite contrary to all tradition. The frame which I now show has proved itself very useful. Traction is easily applied to either extremity or to the pelvis of the patient, and straps may be added to keep the patient from attempting to rise; but with the head-weight this is hardly necessary. The child is perfectly comfortable in it, and I have thus been able to maintain an absolutely uninterrupted traction for weeks at a time.

As regards operative treatment, I am firmly of the opinion that an orthopedic service should be prepared to meet all the needs of an orthopedic case. The old proverb that it is a poor time to swap horses while crossing a stream applies here. To refer a patient who has had mechanical treatment to another for operation, and to have the case subsequently referred back for mechanical treatment, is a division of interest and responsibility that is hazardous of

results. For our operative cases—tenotomies, osteotomies, excisions, etc.—we found the well-developed antiseptic technique of a general hospital of the greatest value. Our records, except those of important cases, were kept in a simple manner. Oceans of valuable time are consumed in these institutions by the internes in writing what no one reads. We make use of a manilla tag tied to the bed. On this, at each visit, is made a note, usually to serve as a memorandum for the next visit.

In ordinary medical or surgical cases which apply at our public charities the burden of attendance may be left to the patient. Not so altogether with our cases. As time, which is very valuable to the poor, passes, and pain and disability are relieved, or the patient gets discouraged, the natural tendency is greatly toward a relaxation of care. This negligence is a source of much disappointment to the surgeon. But it must be encountered as a fact, and these people protected so far as possible from the consequences of their own stupidity and shiftlessness. When a patient remains away for too long a time, a printed notice requesting him to call, and enclosing a postal-card for reply, is sent. If this is ignored a second or even a third is mailed. And in the absence of any reply an assistant makes a call to ascertain the cause. Some only need an admonition; others have passed into other hands. In many instances there is a good reason, such as contagious disease in the family, some exacerbation or intercurrent ailment of the patient, inability of the mother to leave the home, etc. In these and similar circumstances home treatment is provided. Many may be treated at home by a visit once a week or once in two weeks.

Results of orthopedic surgery are only obtained by a liberal investment of effort and perseverance; but they are worth it, and when they come the surgeon has the satisfaction of knowing that he has brought them about, and the reward is great.

SOME OBSERVATIONS UPON THE MECHANICAL TREATMENT OF POTT'S DISEASE.

By A. E. HOADLEY, M.D.,
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Since the introduction of the plaster jacket for the treatment of Pott's disease it has been positively demonstrated that mechanical fixation inducing physiological rest is competent and sufficient means in the majority of cases; and the jacket alone will fully meet these indications when judiciously applied, provided the disease exists below the middle of the upper half of the dorsal region. It is the mechanical treatment of this particular class of uncomplicated cases of which I wish to speak. I do not include those severe and rapidly developing cases that demand extension together with other means of fixation. The amount of deformity which occurs where there has been destruction of the vertebral bodies depends upon the number of bodies involved and the extent of destruction of each, and also upon the treatment which has been employed to restrain deformity. Upon the first condition depends all the deformity that must of necessity occur, as in nearly all cases of recognized spondylitis there must be a deformity more or less pronounced and in accordance with the extent and rapidity of the destruction. It is quite a popular idea that the deformity could have been entirely prevented had restraining treatment been instituted early enough. That opinion, which is shared by a good many men of experience, is only partly true. It is true to the extent that if treatment is commenced early enough to prevent the entire destruction of a vertebral body, then deformity will not occur. But it is not true that deformity can be prevented by any kind of fixation, dressing, or restraining treatment if there is entire destruction of the body of a single vertebra. Then the deformity will occur in spite of treatment

and in proportion to the number of bodies involved and to the extent of involvement.

Deformity can be wonderfully modified, it is true, by judicious treatment, but the contraction and solidification of the new organizable material thrown out at the seat of disease will with certainty deform the column. Even though there is but a single body destroyed, the vertebra above and below will be approximated, and the tip of the spinous process of the diseased vertebra will be tilted upward and pushed slightly backward, forming the prominent little nub on the back, and this without any evidence of falling forward of the upper segment of the column, or any compensation curve above or below to indicate that any other than a direct approximation of the upper and lower bodies has occurred and the column made shorter by the thickness of nearly a vertebra. The first appearance of this little deformity makes diagnosis sure, and with the prompt application of a plaster jacket the patient goes on very comfortably, and makes a good recovery without any increase of the angular curve.

So striking are the benefits of the treatment in these, the most simple as well as the most common of all cases of Pott's disease, that many are led to the erroneous conclusion that if the diagnosis could have been made a few days earlier no deformity would have occurred. This opinion is strengthened by the fact that occasionally a diagnosis of Pott's disease is made before deformity occurs, and under prompt and efficient treatment it never does occur. In those cases with a mild and undulating character of deformity, the deformity will be at once greatly modified, or even obliterated, and if not obliterated at once, it may, in the course of development and corrective force, entirely disappear. The foregoing statements of pathological condition have been made for the purpose of showing that the mechanical treatment should not, as is too often the case, aim at the absolute prevention of deformity, or even of correcting deformity that already exists. But its object is more to prevent unnecessary deformity and to assist in compensating by sustaining the column through the process of degeneration and absorption of the tubercular tissue, the solidification and ankylosis of the adjacent vertebræ by means of ossification of more or less of the new cicatricial tissue, which forms in and around the seat of the disease. When we under-

stand that with destruction of vertebræ there will come deformity, we can with much better judgment apply restraining force than we can if we expect to control deformity absolutely. The results will be better and the treatment more comfortable to the patient. As before stated, deformity must occur where there has been sufficient destruction of the bodies; but there is a class of cases where one or more bodies have been involved sufficiently to produce deformity, and still have enough left to sustain the integrity of the column under the influence of treatment if commenced very early.

In these cases deformity can not only be prevented, but that which does exist, though quite severe, can be entirely obliterated in some instances. There are many of these cases on record, but they are all cases where a considerable portion of the posterior part of the body remains intact, the disease being confined to the front part of the body or bodies, or possibly the lateral aspect, in which case there will be a well-marked lateral deviation as well as backward curvature. When in these cases, which are most favorable for the correction of deformity, if the treatment, which must be most scientific and applied with the best skill, be delayed a few weeks, it will be of little avail; the deformity will be permanent. An indication as to the degree of destruction is found in the character of the backward curve. The sharper the angle the more complete is the destruction of the body and the less likely to be corrected. A very acute and prominent angle cannot be obliterated.

In the application of mechanical treatment in Pott's disease, at or below the upper third of the dorsal region, there are three essential points of fixation to be considered, of which two are in front and one behind. Of the two in front, one is the lower part of the column, or the pelvis, and the other is the upper dorsal spine, which can be fixed by means of pressure over the upper part of the chest. The one behind is at the seat of disease and below it. If these three points are well fixed relatively to each other, and maintained a sufficient time, the best possible results will follow. To maintain these three points in relative fixation is the problem. It would seem from the history of cases, and the observations of practitioners and clinical experience, that it is either not an easy one or is not well understood; for in a majority of all cases treated with either jacket or brace, except those treated by the specialist, the support has been defective

in one or more of these points. This can be well illustrated by criticising some of the jackets that we have taken off that have been applied by the general surgeon, and, in fact, teach a better lesson than to rely strictly upon a description of the proper application. For instance, it is common to find a jacket which will average half an inch in thickness throughout, and having been put on without being rubbed down, was not only very heavy but loose and shaky, instead of being hard and tinny in structure. Then, again, the one who puts on a jacket of this character is apt to have a misconception of the dinner pad. Consequently one four or five times larger than is required, if one is ever required, is used, and that made to cover the entire abdomen, so that when removed the lower end of the jacket can be pulled out behind far enough to enable one to see and feel the deformity. In such a jacket there is no fixation at the lower anterior point. The upper end of the jacket is applied without due regard to the objects for which it is being put on, is usually carried up to the lower border of the axilla, and is made as high and as firm behind as in front—and this is, by the way, in front especially, the weakest part of the jacket. The strongest and most rigid part is that which encircles the body opposite the disease. Such a jacket is no support to the upper anterior point, where fixation should be made; and with these two points, or even one, unfixed, of what service is the jacket in the treatment? The failures, which have of necessity followed from such indifferent treatment, have led many a good man to condemn the plaster jacket and adopt some form of spinal brace for the mechanical treatment. This, of course, is open to the same criticisms, as it is applied in the majority of all cases treated from all sources, and especially those turned over by the general surgeon to the instrument maker for treatment, so to speak.

The instrument maker places the patient in a brace which has many of the accessories that none but the artisan can appreciate. It usually consists of belt, crutches, pads, extensions and corset waist, etc. In the first place, the pelvic belt is made very frail for the purpose of elegance and lightness, and as it is made to encircle the pelvis between the crest of the ileum and the trochanters, it can only be efficient as a means of support for the crutches in those patients who have a good development of the hips, which is not the case with the great majority of cases of Pott's disease. As it practically gives

no support for the crutches, which are intended to carry the shoulders, the chief value of such a brace, which is not much, is lost. Then, again, the upright which supports the pads behind is secured at the top to the crutches by means of a strap which passes over the shoulder. This is usually the only means of securing the upper part of the column from falling forward. The shoulders are so freely movable that the patient is compelled to support himself by muscular action, by holding the shoulders forward. The pads are rarely ever made to accurately fit the back. This, of course, is not a steady and uniform pressure, and, therefore, does not meet the first principles in the indications for treatment, namely, those of fixation and rest. When the pads are put on with springs the apparatus is still more tiresome and inefficient. Often, in consequence of that unremitting spring pressure, patients have been obliged to leave off the brace or have the springs removed. The only element that the broad band of elastic webbing adds, which is so often put on with the brace, is one of discomfort.

Having enumerated some of the objections to the jacket and brace as we find them applied in practice, it will be in order to suggest the simplest means which can meet the indications of treatment and obviate the errors so often made by the inexperienced. In most of the cases, especially in the early stage of the disease, the plaster-of-Paris jacket is the most comfortable as well as the most efficient treatment. In the latter stages, when the diseased portion of the column is nearly consolidated, the brace becomes the most desirable mechanical treatment.

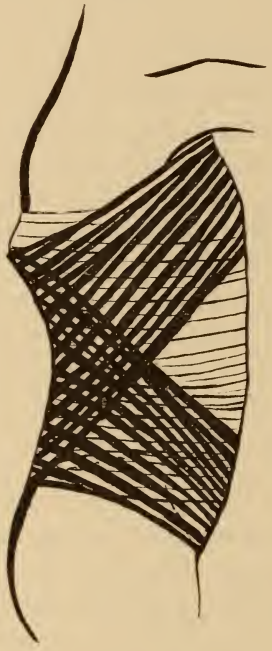
In order to make a good plaster jacket it is necessary to have good material. Not only must the plaster and crinoline be of good quality, but the bandages must be well prepared and of recent make. It will probably not be amiss to say a few words regarding the best method of preparation. The heaviest quality of crinoline should be selected, and the bandages should be two and a half inches wide and five yards long. For the purpose of impregnating with plaster the finest meshes and the ultimate spaces between the fibres of which the fabric is constructed, it is advisable to wind the bandage around the hand in the loosest possible manner and secure the roll, or more properly the skein, with a safety pin transfixing the skein on one side. This should be made so loose that the plaster can easily come

in contact with all parts. These skeins should be placed in a box with a tight cover, together with a quantity of plaster, and the whole tumbled for some time, which will thoroughly infiltrate the fine plaster in the cloth. To facilitate this process the box should be hung on a pivot and revolved by means of a crank. A box fourteen inches square serves the purpose admirably. After the bandages have been thus tumbled with the plaster they are to be drawn through the plaster and rolled in the ordinary manner. Such a bandage, freshly made, will take the water very readily, and when applied it will be found to have sufficient plaster within it to rub down smooth and solid. To properly apply the plaster-of-Paris jacket it is necessary to first make the bottom of the jacket in order to constitute the lower anterior fixed point. This is done by starting the bandage across the lower part of the back corresponding to the upper part of the sacrum. Then pass around to the front below the crest of the ilium and down across the lower part of the abdomen as low as possible. It very often happens that it does not go low enough. It should be drawn as tightly as possible from one anterior spine to the other, and if it is made to go low enough the lower part of the jacket will be almost straight from side to side on its anterior plane in front. This part should be made very strong and heavy in front, and no dinner pad allowed to project from beneath the lower margin. As the construction of the jacket progresses it should become thinner in front and thicker behind until the seat of the disease is reached, when the character of the work should again change to heavy and very high in front, and thin and light behind above the deformity. In putting on a jacket in this way one almost instinctively puts on a figure-of-8 bandage, alternately high and low in front, crossing the back at or below the seat of the disease, or the middle of the back if the disease is in the lumbar spine. After the jacket is thoroughly dry and hard, that portion which is not strictly within the range of a figure-of-8 is superfluous, as suggested in Fig. 1.

There is no real necessity for the bandage to extend above the seat of disease behind, and the only excuse for doing so is that it may stiffen the strong upper front part, which is one of the essential points of support. The abdominal portion is equally superfluous and to the same extent. When the jacket is perfect in the essentials this abdominal portion may be cut away, but should this last

be contemplated the jacket should be constructed with that end in view, which is not advised as a uniform practice. The suggestion is more for emphasizing the principles of construction than to introduce anything new. When the jacket is to be cut open and bound with lace hooks it is not desirable to have a deficient abdominal portion. Since having rigidly adhered to the above principles in the application of the plaster jacket, the dinner pad has been more and more

FIG. 1.



neglected, until now it is no longer thought of, and the disuse has never in a single instance been regretted. The only pad that seems to serve a never-failing purpose is a small narrow and thick pad over the most prominent portion of the deformity. A pad about a half or three-fourths of an inch wide, by one-fourth thick, is placed over the apices of the projecting spinous processes. This can be pulled out from above, leaving a depression on the inside in which the spinous processes can find relief from pressure. At the same time the jacket can be moulded down very close to the back and

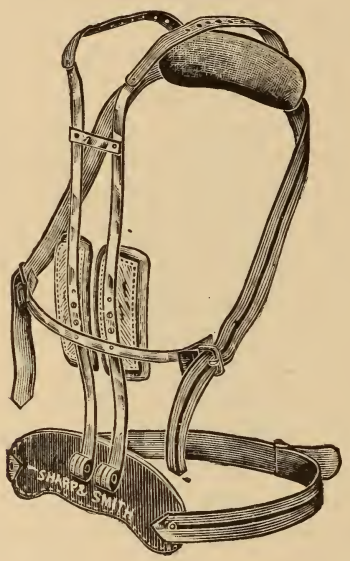
provide the widest possible surface for pressure, and on the tissues which can best tolerate it. It frequently happens, and in fact it is the common practice for the purpose of protecting the prominent nub on the back, that each side of the spine is provided with a pad. This is a mistake, for unless the pad is very thick, it wears down, and the prominent spine is the only portion in the region of the disease which touches the jacket. It soon excoriates, becomes very sore, and it has often furnished a necessity for the removal of the jacket and the addition of more padding, or cutting out a portion of the back of the jacket to accommodate the projecting spinous process. Then the surrounding surfaces of the back are not in contact with the jacket, and consequently firm and efficient support is wanting and additional deformity can take place.

When it seems desirable to adopt the brace the following point should be considered in addition to the principles already referred to: that is, whether or not the crutches should be used for the purpose of carrying the shoulders. Here it may be well to suggest a rule that in a general way will help to decide, although it is by no means without many exceptions. The more vertebræ involved, the greater the deformity and the more serviceable can the crutches be made. Therefore, in a case that is not progressive, which involves but a single bone, it is not necessary to put on crutches, and when not necessary they are a detriment. When several bodies have been destroyed and much deformity exists, with the suspension of the activity of the disease, and before consolidation is quite firm, it is very essential to use them. The patient will instinctively rely upon them whenever he anticipates a sudden movement or a shock of any kind.

In most cases they can be dispensed with to the comfort of the patient long before the back brace is discarded. The brace without the crutches, in its most efficient form, is an exceedingly simple affair. It should consist of pelvic belt, two parallel uprights at the back, supporting a large thin pad on each side of the spine opposite the disease, secured at the top by a strap passing from the top of each upright over the shoulder and across the upper part of the chest and around under the opposite arm to the upright of that side, and a well-fitting, thin, long and narrow pad across the upper part of the chest over which the straps pass.

The pelvic belt should be the usual light band of steel secured in front by means of strap and buckle; or, better still, the back of the belt should be of metal, and the front half entirely of leather and made wider where it crosses the abdomen. Such a belt is only intended to keep the lower ends of the uprights in contact with the back and not to sustain weight. The shape should be such that it will fit the back closely and allow the front part to cross at the lower part of the abdomen. It should occupy almost the same position

Fig 2.



that a well-fitting inguinal hernia truss spring does. This always insures the best support and without constricting the abdomen in the least. The uprights, two in number, should be secured to the belt by means of a hinge-joint, which will allow the belt to adjust itself by permitting antero-posterior motion and pass up the back parallel, one on each side of the spine, to nearly the top of the scapula, where they should diverge until the upper ends correspond to the junction of the upper surface of the shoulder and the neck about one inch below it. They should be secured to each other by means of a crosspiece of metal at the point where the upper ends begin to diverge, and opposite the tenth rib

there should be another crossbar secured to the upright, made long enough to reach the posterior axillary line when it has been shaped to fit the body. To each end of this crosspiece a buckle should be secured at proper angle to receive the strap that comes over the shoulder from the top of the opposite upright. Throughout the entire length they should accurately fit the back. In order to accomplish this it is necessary to take the shape of the back on each side of the spine, by means of the strip of lead, and transcribe the shape on paper, to make a working drawing. The patient should be sustained in as straight a position as possible while the form is being taken.

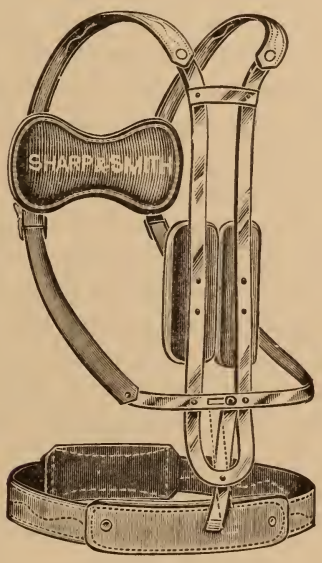
The drawing should also show the exact position of the belt in its relation to the uprights as to angle, height, etc. The pads should be thin, lightly padded, made to fit the surface accurately, and cover as large an area as practicable. When the pads are secured to the uprights they will set the latter away from the body the thickness of the pads at that point, and perhaps double that distance at the upper ends, which is quite sufficient to prevent any unpleasant contact, and secure at the same time a very close-fitting brace, with room enough to provide for compensation at the top. From time to time both uprights and pads can be easily changed in shape for the purpose of readjustment. The chest pad can be made of wood, hard rubber, or thin metal, brass being the best of the metals and easiest of all materials to work. Thin brass can be hammered to fit readily, and then it retains the small studs or buttons well, which are to hold the straps in place. Hard rubber is perhaps the most elegant material, but it is much more troublesome to handle. The upper central part of the pad should rest upon the sternum just below the sternal heads of the clavicle. The upper margin of the pad should slope each way from the centre downward and outward in a groove below the clavicle and in front of the shoulder to nearly the lower margin of the pectoral muscles. This groove is bounded by the clavicle and shoulder joint on the upper and outer side, and by the thorax on the lower and inner side. It can be appreciated to advantage by having the patient, with bare chest, before you, and with the tips of the fingers trace the groove while the patient is making moderate forward and backward movements of the shoulders. In this way one can readily appreciate the exact position for the upper margin of the

pad. This should be traced with a pencil, and a paper pattern cut to fit. The pad, in the average case, should be about two inches wide, and, therefore, when complete, it is somewhat crescent-shape. This shape will be found to vary greatly in different patients. The padding should be thick and rounded at the upper and outer parts of the pad, thin and flat below and in the centre. The round upper margin can be hammered on when the brass plate is used. In any case where a metal frame for the pad is used it should be hammered enough to give it stiffness. The upper margin of the pad should be provided with a post-button on each side corresponding to the uprights, and the lower outer margin or angle on each side should also be furnished with a button. The straps which pass over the shoulders are to be provided with buttonholes as close as they can be conveniently made, for the purpose of buttoning on the chest pad. After the strap has been buttoned to the top of the pad it may be found more convenient for the strap to pass to the lower button of the same side, and then to the crossbar where it buckles, than to cross to the opposite side, as before suggested. Or it may be thought more convenient still to have short straps attached directly to the lower outer angle of the pad, to buckle to the crossbar, and then, of course, the straps attached to the upper ends of the uprights would be short, simply long enough to button on to the upper margin of the pad. In consequence of the rolled and thickened upper margin of the pad, there is a strong tendency for the lower angle of the pads to tilt out, so that in the adjustment of the lower end of the strap it is only necessary to have it tight enough to hold the pad in even contact with the chest. It will then be found that the greatest tension is on the straps which pass over the shoulders. This very simple and inexpensive apparatus, with the proper adjustment of the straps, will sustain the convalescent patient very comfortably and securely, and at the same time not so rigidly but what the patient can by the slightest movement of the body relieve any particular point from pressure momentarily, which makes firm corrective pressure tolerable. It also provides for each of three points for fixation very efficiently.

Fig. 3 is introduced to illustrate an attachment that I have recently adopted for giving motion in the lumbar region. It provides for motion of the hips, and obviates the tendency of the brace to climb up.

The reasons why this apparatus is not desirable in the early stages of the disease are because it permits a greater range of motion of the body, and it is not as comfortable to sleep in, and consequently should not be put on until it is safe to allow the patient to sleep without any apparatus whatever. The jacket furnishes not only the best possible fixation, but maintains a greater part of the body quiet, and that with the greatest comfort, and it is not uncomfortable at night. When it seems best to use the crutches a very

Fig. 3.



different form of pelvic belt should be constructed. A piece of heavy leather from two and a half to four inches wide, cut so as to lie flat in the back and then pass around forward and downward to the bottom of the abdomen, with the upper margin of the leather extending at least an inch above the crest of the ilium. This should be thoroughly wetted and a wedge-shaped piece removed from the upper edge over the crest; then it should be accurately moulded and fitted, and the margin of the notch where the wedge-shaped piece was removed closed with stitches. After it has been thoroughly moulded to the form, including the crest of the ilium it should be bound to the patient until it is dry — about six hours. It

can then be removed, and it will retain the shape of the body. It should then be reinforced with the usual thin belt of steel, which, by the way, need not pass farther forward than the anterior superior spine. The front of the leather is to be trimmed down on its upper margin to an inch or an inch and a half in width and provided with a lacing of three hooks. To the steel portion of this belt is to be attached the crutches as well as the uprights at the back, previously described, which, by the way, should be made from one to two inches longer, as with the use of crutches the shoulders are carried considerably higher. The amount required can be readily estimated by shoving the patient's shoulders up while the measure is being taken.

The attachment of the crutches should be by means of a rivet which will permit of forward and backward motion. The ordinary extension bar should be used, and the upper or crutch end left perfectly free; no straps before or behind; no elastic webbing around the body or across the abdomen.

The belt just described can be fitted upon any patient, no matter to what extent the deformity has progressed; there will be sufficient crest found if sought for, over which the leather can be moulded, to insure perfect and competent support for the shoulders; and this is all that we expect to do with the crutches. In the average case such a pelvic belt will, with ease to the patient, support the whole upper part of the body. It is not tiresome; it does not excoriate. It is not expensive, and should always be used when, for any reason, it is desirable to have support from the pelvis. During the last few years the brace has been elaborated into a most complex combination of adjunct bars, supernumerary pads, ratchets, rack and pinions, set screws, adjustable extensions, lock and swivel joints, levers, compound and simple, springs of all kinds, before and behind, and hinges, both false and real, all in graceful proportions, with finished and elegant workmanship, ornamented with fancy leather and embroidery, until the general surgeon, at least, looks upon one of these highly wrought and elegant instruments with bewilderment, and it is the general surgeon who treats the greatest number of cases of Pott's disease. He knows very well that he has not given time enough to that department of mechanics to suggest any changes, so with the statement that there is nothing too good for his patient, the

elegant encumbrance is ordered, and the application and adjustment left entirely with the instrument maker.

Thus it comes, and it seems a strange assertion to make, that as the brace has developed in multiplicity of parts and elegance of construction it has deteriorated in usefulness in the hands of the general surgeon. Many an opportunity has been improved to examine patients, both in public clinic and in private practice, who have been enveloped in one of these elegant complexities, and we could demonstrate, in most cases, that they were absolutely useless. They were made and put on by an instrument maker who works according to certain drawings and rules, and he does his best by putting the parts as near as possible in the right place. Then he puts it on, which is all he can do. Why it is a failure he does not know. And why should he? Neither does the surgeon, and why should he not? That is the question the solution of which has been the excuse for this paper.

OSTEOCLASIA.

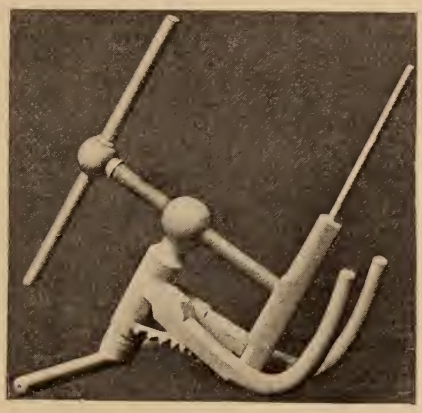
By NICHOLAS GRATTAN, F.R.C.S.,
CORK, IRELAND.

In 1887 I commenced to practise osteoclasis of the extremities. My first fractures were for curved legs; the instrument used was an ordinary carpenter's screw-clamp with a wooden arrangement, between which the bones were broken. Pressure was made by means of the screw, and the points of pressure were thickly padded with felt. These cases succeeded admirably.

A very severe case of knock-knee having come under my care, it occurred to me that I might possibly be able to fracture the femurs close to the knee-joint, and by this means might easily correct the deformity. For this purpose I had a special instrument manufactured. In the orginal instrument the pressure-bars were covered with thick felt or India-rubber. After a few cases of osteoclasis of the femur all pads were disregarded, and I had the pressure-bars highly polished, having found in practice no difference in the results of the felt or rubber-covered bars and those of polished steel.

From time to time my osteoclasts have been altered so as to render them more powerful, but the general plan of the instrument and the details of the operation remain the same as at first. The instrument I use consists of two curved bars, which can be approximated or separated as may be desired. These bars are connected together by means of a strong pivot, to one end of which is attached a crossbar for the purpose of preventing the instrument overturning when in use. Through the other end of the pivot the screw works, to one end of which is attached the handle; the other end is fitted into the pressure-bar, which is straight; the part through which pressure is applied to the limb is oval in shape, in

order to prevent its cutting the skin. A long rod is inserted into one end of the pressure-bar; this is used to prevent its rotating on the limb when the screw is turned. The three bars are sufficiently long to prevent any entanglement in the skin. The curved bars, which oppose the pressure-bar, are circular in shape. Underneath the bars is a rachet, each division of which corresponds to opening the curved bars half an inch. This is necessary, otherwise the pressure would force the curved bars more closely together than might be desired. It will be seen that by this arrangement of the curved bars it is possible to apply pressure and counter-pressure at any point which may be desired.



Instrument for performing osteoclasis.

I have adopted a screw as a means of making pressure in preference to a lever, because of the greater portability and ease of applying a screw arrangement to the requirements of different patients. The disadvantage of a screw consists in not being able to apply pressure with the great rapidity that is possible with a lever. But I find that this great rapidity is not necessary, and that the screw osteoclast in my hands performs its work satisfactorily. Should I find my present instrument fail in power, I shall, of course, have a larger and more powerful one manufactured.

In operating on a femur for genu valgum, in order to break it: One curved bar of the osteoclast is placed on the outside of the

femur, just above the condyle. The other curved bar is placed from one and a half to four and a half inches higher up the limb, according to the age of the patient. The oval-shaped bar in which the end of the screw works, is applied to the femur on its *inner side transversely*, midway between the outer bars. The three bars are held in position on the limb by an assistant, who must prevent the pressure-bar rotating by grasping the long rod which is inserted in it. The assistant must also take care that the pressure-bar does not compress the femoral vessels, and that *the skin under the pressure-bar is quite loose*, otherwise it will be more likely to tear. All being ready, the operator turns the screw quickly and forcibly, until the bone is felt or heard to break. After the bone has been broken and the osteoclast removed, the operator takes the limb in his hands, feels that all the fibres of the bone have been torn across, and sets the ends together in their new position.

In extreme cases of genu valgum, where the deformity is in part caused by the tibia and fibula, these bones may also be fractured close to the knee-joint and the deformity corrected.

Bow-legs (curved legs) are likewise broken across in the same way. The pressure-bar is in these cases usually placed on the outside of the leg. Occasionally it has been found necessary to fracture the tibia and fibula in more than one place to correct the deformity.

In all the cases operated on it was surprising to see the small amount of injury inflicted on the skin. After the third day but slight ecchymosis remained at the points of pressure. The pain did not last more than twelve hours, and is not greater than after an osteotomy. All the cases ran the ordinary course of simple fracture, and all united without any delay.

Both in knock-knee and bow-legs, the fractures having been completed and the deformity corrected as described, the limbs are kept in position by means of some simple fracture apparatus. All the cases of knock-knee have had some form of extension applied, and most of them have been corrected with a slight outcurve. About the end of the first or second week it will be necessary to examine the limb. If the deformity has not been entirely corrected, the bone can be easily manipulated into any desired position.

In the south of Ireland, where I reside, club-feet of the most severe description are very prevalent. To correct these, I have on twelve occasions removed astragali, with anything but satisfactory results, as regards the deformity. In these cases I have, with great advantage, fractured the legs quite close to the ankle-joint, and again half-way up the limb. These fractures having been completed, I have been enabled by rotating the foot to get it everted, and by the fracture close to the ankle-joint to get the sole of the foot flat on the ground. I am much pleased with the results of this operation. It has given to nearly all my patients good and useful feet.

Several tarsi have also been crushed and torn with this instrument with the best results. I invariably use the osteoclast when I am unable to exert sufficient force with my hands.

Results of One Hundred and Eleven Operations.

I have, in Cork, treated 44 patients on whom I performed 111 operations. They all recovered perfectly, with but little pain and no constitutional disturbance whatever.

I have the pleasure of exhibiting to you photographs of my most severe cases, taken before operation and at long intervals after, when my patients were walking about.

I have also brought with me for your inspection, a portion of a femur, together with the knee-joint, taken from a little girl, E. H., who died three and a half months after osteoclasis of her femurs. She had recovered and was walking about at the seaside when symptoms of tubercular meningitis developed, of which she died in a week.

(See table of cases on next page.)

No. in Case-book.	Initials.	Age.	Sex.	Date of first operation.	Date of discharge.	Knock-knee. Femurs fractured.	Knock-knee. Leg fractured.	Bow-leg. Leg fractured.	Club-foot. Leg fract'd and rotated.	Club-foot. Tarsus crushed.	Other.	Observations.
1	M. L.	3 years	F.	Dec. 3, 1887	April 6, 1888	...	...	2				
2	J. K.	3½ years	M.	June 6, 1888	July 26, "	...	...	2				
3	M. S.	11 y. 2 m.	F.	July 25, "	Oct. 26, "	2						
4	E. B.	12 years	F.	Sept. 18, "	Dec. 1, 1889	1						
5	C. S.	12½ "	F.	Mar. 23, 1889	June 20, "	1						
6	H. W.	3½ "	M.	May 25, "	Aug. 30, "	2						
7	J. K.	13 y. 14 d.	F.	June 18, "	Aug. 1, "	1						
8	J. K.	1 y. 8 m.	M.	July 19, "	Oct. 8, "	...	...	2				
9	B. N.	2 years	F.	Aug. 21, "	Oct. 1, "	1						
10	E. B.	1½ "	M.	Sept. 9, "	Oct. 10, "	...	...	...	...	...	1	Angular deformity of radius and ulna.
11	C. B.	1½ "	M.	Nov. 21, "	Jan. 7, 1890	...	...	2				
12	N. M.	9 "	F.	Dec. 8, "	Mar 29, "	2						
13	J. R.	2½ "	M.	Mar. 8, 1890	April 7, "	...	...	2				
14	K. A.	14 "	F.	Dec. 28, 1889	Apr. 24, "	2						
15	E. J.	6 "	F.	Jan. 16, 1890	May 7, "	2	1	2				
16	J. M.	11 "	M.	Mar. 13, "	Jan. 1, 1891	2	1	2				
"	"	" "	"	Apr. 18, 1891	Oct. 6, "	2	...	...	...	...	...	Relapse.
17	H. D.	17 y 10 d.	F.	May 18, 1890	Dec. 2, 1890	2						
18	D. B.	19 years	M.	Sept. 17, "	Dec. 19, "	3	2	...	...	...	...	Right femur in two places.
"	"	" "	"	Jan. 27, 1891	June 4, 1891	1	...	...	...	...	...	Relapse. Right femur.
19	J. B.	6 years	F.	Oct. 8, 1890	Nov. 28, 1890	...	...	2				
20	P. G.	9 "	M.	Nov. 18, "	April 4, 1891	...	...	...	3	...	...	Left leg in two places.
21	M.O'L.	10 "	F.	Dec. 2, "	Feb. 24, "	...	...	...	2	...	...	Left leg in two places.
22	G. H.	2½ "	F.	Dec. 30, "	Dec. 9, "	...	...	...	4			
"	"	" "	"	Feb. 26, 1892	April 9, 1892	...	...	...	1	1	...	Relapse.
23	N. S.	6 "	M.	Jan. 7, 1891	July 17, 1891	2	2	1				
"	"	" "	"	Mar. 19, 1892	June 1, 1892	1	...	...	...	...	...	Relapse.
24	E. K.	6 "	F.	Apr. 18, 1891	July 24, 1891	1	...	1				
25	M. D.	3 "	M.	May 19, "	.....	2	...	...	2			
26	T. B.	5 "	M.	Apr. 25, "	July 20, 1891	2						
27	J. W.	6 mos.	F.	June 21, "	Oct. 7, 1892	...	...	...	2	2	...	Died Oct. 11, 1891, of measles
28	P. D.	2 years	M.	June 21, "	Mar. 29, "	...	...	...	2			
29	J. R.	2½ mos.	M.	July 9, "	Sept. 5, 1891	...	...	...	2	2		Died, Oct. 2, 1892, of diarrhœa.
30	H. P.	3 years	M.	July 14, "	Oct. 29, "	2						
31	W. F.	1 year	M.	July 17, "	Sept. 1, "	...	...	...	1	1		
32	W. L.	2 years	M.	Aug. 15, "	Sept. 27, "	...	...	2				
33	J. H.	3 "	M	May 23, "	Apr. 11, 1892	...	...	...	1	1		
34	J. S.	17 y. 2 m.	M.	Aug. 17, "	Oct. 28, 1891	2						
35	W. D.	3 weeks	M.	Aug. 18, "	Oct. 7, "	...	...	...	...	1	...	Doing well.
36	J. M.	5 years	M.	Oct. 24, "	Dec. 5, "	2						
37	F. M.	3½ "	F.	Jan. 19, 1892	June 30, 1892	2	...	2				
38	E. H.	4 "	F.	Oct. 28, 1891	Jan. 1, "	2						
"	"	" "	"	Mar. 2, 1892	June 1, "	2	...	...	...	...	...	Relapse.
39	M. S.	6 "	F.	Nov. 14, 1891	Jan. 14, "	...	...	1				
40	E. M.	14½ "	M.	Feb. 25, 1892	April 5, "	2						
41	H. R.	2½ "	M.	May 11, "	June 28, "	...	...	2				
42	M. S.	3 "	F	July 2, "	.....	...	...	2				
43	E. M.	1½ "	M.	July 4, "	.....	...	...	...	...	1		
44	R. W.	14 y. 3 m.	M.	July 29, "	.....	2						
						48	6	27	20	9	1	= 111 total

THREE CASES OF SPASTIC HEMIPLEGIA TREATED BY OPEN TENOTOMY OR MYOTOMY IN THE FOREARM AND HAND.

By AUGUSTUS THORNDIKE, M.D.,
BOSTON.

Although neurologists have not as yet expressed their approbation of tenotomies for the amelioration of the gait in cerebral spastic paraplegia of children (Little's disease), yet the published experience of many, like Rupprecht[1] in Germany, Adams[2] in England, Bradford[3] and Bullard, Scudder,[4] Willard[5] and others in this country, has led orthopedists to regard spastic paralysis of the lower limb as a condition usually remediable under surgical treatment with or without the use of apparatus. The present attitude of many nervous specialists is shown by the following quotation from Gowers's *Diseases of the Nervous System*, vol. i. p. 453, edition of 1892: "The tendo Achillis is sometimes divided for contracture of the calf-muscles, but the operation is useless and ought never to be performed." Nevertheless, I venture to say that there are few orthopedic surgeons in this country who have not seen good, nay, even brilliant, results from this very operation.

In the upper extremity, however, the task of restoring the impaired function presents difficulties which do not occur in the leg and foot; instead of merely improving locomotion, the operation aims to restore the power of grasping and lifting with the hand, and to obtain, if possible, precise and delicate motions with the fingers, and comparatively few have attempted it. It follows as a matter of course that very few such operations have been published,

[1] Volkmann's klin. Vorträge, p. 172.
[2] Adams: Lancet, September 27, 1891.
[3] Trans. American Orthopedic Association, vol. iii. p. 7.
[4] Ibid., vol. iv. p. 366. [5] Ibid., p. 391.

and I shall therefore confine myself to a report of three cases—one of Dr. Bradford's, one of Dr. Burrell's, and one of my own—all hitherto unpublished, and in all of them the condition of the hand is known more than one year after operation.

No claim is made to a permanent and absolute cure; for although many of the results obtained in the foot have been brilliantly successful, it does not seem possible that dividing with the knife the bellies or tendons of the affected muscles can cure the central nervous lesion on which the condition depends. All that is claimed here is that in these few cases of tenotomy or myotomy in the forearm and hand—cases where the operator felt that he was invading the dangerous ground of experimental surgery and was taking great risks in a locality where septic infection would be disastrous in the extreme—in all three of these cases there has been some improvement of function.

It was not my intention to refer to trephining and the older operation of nerve-stretching for the relief of spastic hemiplegia; but I believe that the results here reported show greater improvement in the utility of the hand than any recorded cases where the lesion has been localized and attacked at its focal centre.

Case I.—Miss X. was a private patient of Dr. Bradford's, who has kindly given me the following notes: At eighteen months she presented herself with spastic hemiplegia of the right hand and foot. The foot was in a position of moderate equinus; the knee was not affected; the adductors and other thigh muscles not involved; ankle clonus was present. The arm hung with the elbow semiflexed, the hand in extreme pronation, the wrist slightly flexed, the fingers and thumb not bent, but the thumb carried in on to the palm of hand. After the tenotomy of the tendo Achillis the child soon learned to walk, and the arm was at first treated by massage only. This was five years ago. No apparatus was used after removing the plaster bandage on the foot. As the child grew older she learned to use her hand a little, but the mother insisted on having the same operation performed on the hand as on the foot, and two years after the tenotomy of the tendo Achillis, Dr. Bradford divided all the flexor group of muscles in the forearm by an oblique incision starting two fingers' breadth below the bend of the elbow

at the inner border of the supinator longus muscle, and extending obliquely inward and downward to the inner surface of the forearm, taking care in deepening the incision to avoid the median nerve and ulnar artery, which were found and isolated by the anatomical rules usually employed. The operation was done under ether, and was rendered bloodless by the Esmarch method. After all the muscles of the forearm arising from the internal condyle of the humerus had been divided, the resulting dead space was left to heal by blood-clot; the skin was sutured over it, baked dressings applied, and a plaster bandage held the wrist and elbow straight with the hand in extreme supination. Several weeks later the plaster was removed, the wound was all healed, and massage was employed as before. It is now three years since the operation, and the patient still comes in occasionally for observation. She can do many things with her hand and fingers, but as the biceps was not divided there still remains a little flexion at the elbow. The improvement in this case was very great, and the hand is a very useful one.

Case II.—E. W., a colored girl, first brought to the Children's Hospital as an out-patient in March, 1883. She was a year and a half old. She presented a right-sided hemiplegia, which had been noticed for about one year. The arm was flaccid, and the leg had been stiff for about six months. She did not return after her first visit until she was ten years old, when she was admitted by Dr. Burrell to the hospital for operation. At that time (September 9, 1890) the arm hung by the side, and the thumb was flexed stiffly on the palm, and all attempts to extend it beyond a certain point caused great pain. The hand at the wrist was drawn over to the ulnar side and somewhat flexed, and the elbow was also a trifle bent. Under ether the Esmarch bandage and tourniquet were applied, and three incisions were made by Dr. Burrell as follows: first incision, along the web between the thumb and forefinger, dividing the tendons of the flexor brevis pollicis; second incision, three-quarters of an inch long, made in the palm at the base of the thenar eminence and dividing the palmar fascia, which was tense; the third incision was a small one over the flexor carpi ulnaris tendon just above the bend of the wrist, dividing that tendon and several adjacent ones which felt tightly stretched. The wounds were closed by continuous catgut

sutures in the skin; a baked dressing was applied, the deformity reduced, and the hand bandaged to a straight palmar splint with the thumb abducted. The incisions healed without mishap; she continued to wear the splint for about two months. When last seen in January, 1891, four months after the operation, she was gaining in power in using her thumb. I have since heard, through Dr. Bullard, from the child's mother. She came to see him, and in reply to his questions said that the thumb still remains extended, with very little grasping power. The hand is still a little drawn over. She goes to school, but is backward mentally. She still holds her elbow somewhat bent, although she can extend and use it. In this patient the improvement was not very great; but it is possible that had she not been mentally deficient she might have learned to use her hand to better advantage; for there is no doubt that much of the improvement in my own case, which follows, came from the after-treatment —electricity and training the muscles by mild exercises.

Case III.—M. C., aged fourteen years, was referred from the Children's Hospital to the House of the Good Samaritan, on account of her age. She entered on March 3, 1891, and the following history was obtained. She was a well child until two years ago, when after vaccination she had a copious eruption of boils, during which she was suddenly seized with convulsions lasting over an hour, and on coming out she was found to be paralyzed over the right side of her body. In a few weeks power began to return, first in the hip and shoulder, then in the elbow and knee, but she has never gained much in her foot or wrist. The stiffness has been there almost all this time. She was a large, well-nourished girl, not especially bright, but not much below the average of her age in school attainments, and certainly not mentally deficient. There was no facial paralysis. The habitual position of the arm, hand, and leg may best be seen by referring to the accompanying photographs. Both leg and arm were extensively atrophied, and the hand was held flexed at right angles with the wrist; the thumb was folded on the palm and usually the fingers closed over it. On attempting to open the fingers or bend the wrist, resistance was encountered unless the force was applied very gradually and gently, when all resistance immediately vanished. All deep and superficial reflexes on the right side were increased. The fingers were neither

blue nor cold; the right shoulder was a little the higher, and there was a slight lateral deviation of the spine. In the leg the knee-jerk was much increased, and the ankle clonus was very troublesome, as it came on at every step. There was half an inch of absolute

Fig. 1. Fig. 2.

Shows the position. Shows the atrophy.

shortening in the leg and a still greater difference in the arms. The atrophy is shown by the following measurements:

Measurement around the upper arms: right, $8\frac{1}{4}$ inches; left, $9\frac{1}{4}$ inches.

Measurement around the forearm: right, 7 inches; left, $8\frac{3}{4}$ inches.

Measurement around the thigh: right, $16\frac{1}{2}$ inches; left, $18\frac{3}{4}$ inches.

Measurement around the calf: right, $11\frac{1}{2}$ inches; left, $13\frac{1}{8}$ inches.

The right humerus measured $10\frac{1}{2}$ inches, the left 11 inches.

The right ulna measured $8\frac{5}{8}$ inches, the left $9\frac{1}{4}$ inches.

A large amount of shortening for the arm, considering the comparatively brief duration of the affection—two years.

The foot was first corrected by a subcutaneous tenotomy of the tendo Achillis and plantar fascia. Plaster-of-Paris bandages were immediately applied and kept on for three weeks, after which a Taylor club-foot shoe was worn. She now wears a light outside steel shoe with a right-angled catch at the ankle, and a high sole on her boot compensates for the shortening, so that she now walks without limping.

After correcting the foot, a second operation was performed, one month after the first, on the arm, following the same incision which Dr. Bradford had used in Case I. of this series. The median and ulnar nerves were found by dissecting for them, and the line of incision was carried straight down to the interosseous membrane so as to divide all the muscles of the flexor-pronator group, leaving the two nerves stretching across the space between the divided ends of muscle—a dead space of about an inch and a quarter, which was left to fill in and heal by blood-clot. The ulnar artery was not to be found; the radial was large and was drawn aside with the belly of the supinator longus muscle. The skin was united by catgut sutures, and a baked dressing and plaster-of-Paris bandage applied from the finger-tips to just below the shoulder—the arm bent at a right angle and the hand in the position of extreme supination. There was no pain to speak of, the temperature remained normal, and the wound was found solidly healed on removing the plaster bandage three weeks later. After this a millboard splint was worn, and the child encouraged to use her hand without the splint for an hour or two daily, gradually lengthening the periods of exercise until the splint was wholly discarded. The arm was at first very weak, but a little voluntary flexion of some of the fingers was possible, and there was no stiffness. In a few days, however, there appeared a tendency for the hand to return to the old position of pronation and for the fingers to flex, and this tendency progressively increased in a most discouraging fashion. The extensor group of muscles was weak, and what was at first paretic wrist-drop gradually became stiff and contracted as before, only not to so great an extent. Under electricity and careful teaching she nevertheless learned to

use her hand a little, and could even hold a crochet-needle and do simple crochet-work before leaving the hospital.

Since then she has been to the Out-patient Department for Nervous Diseases at the Children's Hospital, where Dr. Bullard and Dr. Burr have continued the electrical treatment begun at the House of the Good Samaritan. I saw the patient twice in April of this year—one year after the second operation. Her mother had died meanwhile, and the young girl had taken her place, doing all the housework and cooking for her father and the two younger children. She had improved a great deal in using her hand, could feed herself, sweep the floor, stir the saucepans, and make the fire, using her right hand to a certain limited degree; but she could not lift more than one or two pounds with her right arm. This case also, like Dr. Bradford's, shows a great gain in the utility of the hand.

In conclusion, let me call to your attention that in the first case, Dr. Bradford's, where the best result was obtained, the patient was younger, only three and a half years old, instead of ten and fourteen, the ages of the other two respectively. Massage had also been carefully tried for two years, with very little success prior to the operation, and the exercises and massage have been carefully followed out ever since. In Dr. Burrell's patient, however, the final gain was very slight, according to the mother's statement to Dr. Bullard. This child was certainly gaining at the time she ceased to attend the Children's Hospital clinic; but owing to her mental deficiencies she had been unwilling to persevere in following out the exercises, and when left to her own devices she omitted them entirely, and her hand speedily relapsed very nearly into its former state. My own case also emphasizes strongly the necessity for care and perseverance in the after-treatment, for there is no doubt in my mind but that she would have followed in the footsteps of Dr. Burrell's patient had she not been a bright and willing girl, ready to persevere and work in exercising her fingers and to come regularly for her electrical treatment.

These cases are too few to draw conclusions from, nevertheless they do appear to show that improvement may be obtained after tenotomy or myotomy of muscles of the forearm. Also that much of the success should be attributed to careful training of the divided muscles for months after the operation.

A REPORT OF SIX CASES OF EXCISION OF THE KNEE-JOINT.

By JAMES E. MOORE, M.D.,
MINNEAPOLIS, MINN.

In each of the following cases the Esmarch bandage was applied during the operation, but was removed before the wound was closed, in order to control excessive hemorrhage. I have had some unpleasant experiences from neglecting this precaution. My rule has been to make my incision above the patella, since it facilitates the cleansing out of the diseased tissues, and the starting-point being the same, it is just as good for drainage as the lower cut. Where the limb was considerably shortened, a piece was removed from the upper end of the flap. The patella was removed in every instance, because, when the joint is destroyed, it is useless, and it is easier to remove it than to clear it of all disease. Four steel-wire nails were used to fasten the bones together, two above and two below. Rubber drainage-tubes were used in part of the cases only. At the present time I do not use the rubber tubes, because I have found that the tissues around them almost invariably became infected with bacilli. Where a clean wound can be made, drainage is not necessary. A bichloride solution 1 : 2000 was used very freely while the Esmarch was applied, and sterilized water after its removal. Plaster-of-Paris, extending from the toes to the body, was used in every case, because it has proven eminently satisfactory, and because it is more convenient than any other splint. The dressings were not changed for one month, except for special indications. I have experienced no difficulty in removing the nails at the end of the month since I have learned to leave a silk thread attached to the head of each one.

Case I.—H. C., aged twenty-six years, had been suffering from a chronic synovitis of the knee for four years. He had suffered comparatively little pain until within the last few months, when he began to suffer severely and was no longer able to work. The knee was considerably flexed, but he still bore some weight upon it when he walked. It was evident from the long history and from the pain coming on late that the disease had destroyed the synovial membrane and attacked the bones. Although there were no sinuses, it was evident that there soon would be, as the disease had extended well beyond the limits of the joint. A section was removed from both bones, and diseased points gouged out of the tibia. Rubber drainage-tubes were introduced at the lower angles of the wound. Everything went well with my patient until the twelfth day, when he complained of very severe pain at the seat of one of the nails, and had a temperature of 102°. Dressings changed and the offending nail removed, after which the patient was perfectly comfortable. The wound was then, and throughout the treatment, aseptic. At the end of one month the remaining nails and the drainage-tubes were removed. The patient was allowed to get about on crutches at the end of the sixth week. At the end of ten weeks the patient went to the country still wearing a plaster cast, and with sinuses at the site of drainage-tubes. These sinuses were thoroughly curetted and packed with iodoform.

This patient has now a good useful leg, one that enables him to work as a house-carpenter.

Case II.—At St. Mary's Hospital, Minneapolis: C. H., aged twenty-four years, had suffered for four years from chronic synovitis of the knee.

The joint was greatly enlarged and was decidedly flexed. He had been unable to walk for some months. There were no sinuses, but extensive burrowing underneath the skin above and below the joint. A section was removed from both bones and the tibia gouged out. The usual dressings applied and allowed to remain one month. Some trouble was experienced in this case in getting the sinuses extending up under the fascia lata to close; I finally laid them open throughout their whole length, curetted and packed them with iodoform gauze, after which they healed promptly. This

wound was also aseptic throughout. Patient was in hospital four months. He has now a perfect result, and says he can walk as far and work as hard as he ever could.

Case III.—At the Northwestern Hospital, Minneapolis: A. O., aged sixteen years, had had an arthritis for two years. This knee was a typical "white swelling," with the usual deformity. It was painful and sensitive, but there were no sinuses nor was there immediate prospect of any. It was clearly a case for orthopedic treatment, but the circumstances were such that the only way I could save the boy's leg was to excise the knee, and I thought it my duty to do so.

He was an ignorant son of a more ignorant father, and lived a long distance in the country, where treatment could not be carried out. I could not keep him long enough to do him any good in any way, except by an operation. Time and again I have had cases come to me under like circumstances, and return in a year or two to have an amputation performed.

The operation was performed in the usual manner, and the usual dressings applied without drainage. In one month the dressings were removed, when the wound was found perfectly healed, there being no moisture even at the site of the nails. Six weeks after the operation he went home, and at this time it was difficult to keep him from walking upon the leg. He has now a perfect result.

Case IV.—At the Northwestern Hospital: Mrs. B., aged forty years. About two months before the operation, I first saw the patient, and advised excision. The knee was very painful and decidedly flexed, with subluxation of tibia backward. She would not submit to operation at that time, but shortly afterward she had an acute exacerbation and concluded to have the operation performed as soon as she could be gotten into condition for it. The disease was of two years' duration. The operation was performed in the usual manner. The joint was disorganized; the femur slightly, and the tibia considerably diseased. It was necessary to shorten the bones considerably and to tenotomize the hamstrings before the limb could be straightened. One cavity, about an inch

deep, was scooped out of the tibia and filled with iodoform. The usual dressings were applied, without drainage. During the first week the highest temperature was 101° to 102°. After the first week it was never over 99°. The dressings were changed at the end of a month, and nails removed. Patient left the hospital in seven weeks in good condition. The wounds all healed promptly in this case, but firm bony union was slower than usual, so that it was about six months before she could walk upon it. It is now eleven months since the operation, and she has a good straight leg upon which she can walk, wherever she wants to go, with comfort.

Case V.—At St. Barnabas's Hospital, Minneapolis: W. L., aged twenty-four years. Two months before operation I saw this patient in a neighboring city. At that time he was in bed on account of his knee. He had complained of the joint for about three years, but had been able to work most of the time. My diagnosis at that time was chronic synovitis. Advised aspiration and rest, and suggested that an excision would be advisable then, as it would probably be necessary before long.

He could not come to Minneapolis at that time, but two months later was referred to me by his attending physician for excision. When he arrived at the hospital I found that the synovial sac had ruptured, and that there was extensive burrowing of pus above and below the joint. I first made numerous openings at points all the way from the upper third of the thigh to the middle of the calf, and established thorough drainage. After two weeks the patient had improved so much that I concluded to excise the joint, which I did in the usual manner. Several drainage-tubes were used. The serous membrane was destroyed everywhere and the cartilages attacked, but the bones were healthy. I removed just enough from each bone to make good apposing surfaces. On the fifth day, during my absence from the city, my assistant found it necessary to dress the wound, as the patient had a temperature of 103°. After this, his highest temperature was 100°. Three weeks later I made the second dressing, removed the nails, and all the tubes but two. This case was necessarily tedious, on account of the extensive burrowing before the operation. Bony union was prompt and in perfect posi-

tion. The patient was in the hospital all winter, but was able to walk upon the leg three months after the operation. He is now a healthy, active man, with a good, straight leg.

Case VI.—At St. Barnabas's Hospital: C. H., aged eight years, had had a typical arthritis of the knee for over three years, during all of which time he had been a great sufferer. About one year and a half before the operation the child had been brought to me, when I advised the proper orthopedic treatment; but, notwithstanding the fact that he lived in the city, he was neglected, and, of course, grew gradually worse, until he was brought to me the second time, when I found the joint destroyed, the tibia subluxated, and several sinuses discharging pus. In operating, I found it necessary to shorten the leg considerably in order to straighten it. I also tenotomized the hamstring tendons. Owing to the mixed infection existing at the time of the operation, suppuration followed, so that for a time it was necessary to dress the wound every few days. Bony union took place promptly, however, and the boy left the hospital in six weeks. At the present time—about four months after the operation—there is one small, shallow sinus, which is healing slowly, but there is firm bony union in good position, and the patient is in good health, and it is impossible to keep him from running upon the leg.

I believe that in every instance these joints could have been saved by proper treatment at the proper time. The usual diagnosis had been rheumatism, and the treatment poultices, liniments, etc. In none of them had rest been systematically employed.

I also believe that in all cases, except in Case III., after they came into my hands the results from rest would not have been nearly so good as they have been from operation. While some of them might have recovered, it would have taken a long time, and the result would have been a stiff leg no better than they have now. *Others would have resulted in amputation.* I have never found it necessary to excise the joint where rest had been employed early and systemmatically, but have been obliged to amputate in many cases where the treatment began too late or where it had not been properly carried out.

I am not an enthusiast upon excision, and do not approve of it

as a substitute for any other treatment; but I do believe that it has its proper place, and I know from personal experience that in properly selected cases it is one of the most satisfactory operations in surgery.

These are not selected cases, but are six consecutive cases, the last in my series, in which time enough has elapsed to know the result; and the principal reason for the result being so uniformly satisfactory is that I have refused to operate except in cases where this operation was specially indicated. While the result from an early excision would be good, it would be morally wrong, under ordinary circumstances, to operate at this stage, because, by proper orthopedic treatment a movable joint could be secured. On the other hand, excision is not, in my judgment, a substitute for amputation. Where the ravages of disease have been so great that hopes of saving a good useful limb have been destroyed, amputation should be performed. The operation of excision has been brought into disrepute many times, and lives have been lost when it has been performed as an experiment in place of an amputation. Time was when this was necessary, but that has gone by.

Conclusion.—If I have by this brief report once more impressed upon the mind of the general practitioner the importance of early and persistent treatment of knee-joint inflammations; if I have demonstrated, to the specialists here congregated, the correctness of my belief that these knees, coming under treatment at a late date, should many times be excised before they go so far that an amputation is our only resource; and if I have demonstrated that excision of the knee should have a definite place in the mind of the orthopedist, I have attained my object.

DISCUSSION.

Dr. A. J. Gillette said that in view of the fact that such cases often relapse after an interval of two or three years, sufficient time had not elapsed to justify the author in considering these cases as "successful." One or two of the cases seemed to him to be still in

need of orthopedic treatment by immobilization. The treatment in the third case was, in his opinion, rather radical.

Dr. J. C. Schapps asked if the author had experienced trouble from the occurrence of flexion after the operations.

Dr. J. D. Griffith had had flexion in some of his cases, but was no longer troubled with it, as he now makes it a rule always to remove the patella, which is likely to be a source of tubercular infection. A better result would have been obtained in the author's fourth case if an arthrectomy had been performed instead of an excision. The high incision, four and a half inches above the knee, places the incision in such a position as to greatly facilitate the cutting out of the flaps. When the patella is sacrificed, there is apt to be a "sling" of the limb.

Dr. A. M. Phelps said that he had performed about fifty excisions and a number of arthrectomies, but the latter operation was generally not advisable. Of course, its object is to secure good motion and to preserve the function of the quadriceps muscle; but often this muscle is useless, owing to the patella being adherent. There is also less likelihood of securing a firm limb, and hence, at present, the best operators endeavor to secure solid bony ankylosis. Instead of cutting across the bones in the growing limb, it was much better to follow the contour of the limb, leaving the convex surface of the femur and the concave surface of the tibia. He would not perform excision in a child under ten years of age, except for paralysis. If, with a scoop, you can reach into the bone to a point where Nature has formed a barrier to the disease process, you can avoid amputation, and get a very good result.

Dr. H. A. Wilson said that the author had spoken of the plaster-of-Paris splint embracing the entire leg and body. Of ten cases of more or less serious deformity following excisions of the knee-joint, inquiry showed that the splint had embraced the foot and leg, and had terminated one-half to two-thirds up the thigh. The old illustration of wrapping a pillow around a stick, and enclosing it in plaster-of Paris, shows very clearly that with such

a dressing one must depend upon the volition of the patient for immobilization, and this explains the bad results which were obtained. Where the entire leg and body have been enveloped in plaster, union has been more speedy and the ultimate results more satisfactory.

Dr. Moore, in closing the discussion, said that he thought he had been extremely fortunate in having none of his cases so far relapse, and he attributed this chiefly to his keeping the parts in position and well immobilized until firm union had occurred, and also to a proper selection of his cases. The third case, he admitted, was not one for excision; but, as he stated in his paper, circumstances compelled him to do it. It would have been better in the fifth case to have applied a fixation apparatus, but the child was not under his immediate care. He had had no trouble from flexion since he had learned how to do the operation, and where flexion had occurred the disease had returned, either because the cases were unsuitable for this operation, or the operation had not been properly performed. He did not think that ordinarily anything was to be gained from an arthrectomy, and in the cases reported he saw no objection to the radical operation in the first instance, as in none of them did he expect to secure a movable joint. As he had always made it a rule to remove the patella, he had nothing to say about the advantages or disadvantages of so doing. The length of the splint was a matter of great importance; usually it was made too short.

PERIPHERAL NEURITIS AND SCAPULAR BRACE.

By H. HODGEN, M.D.,
ST. LOUIS, MO.

In the two following cases the symptoms were identical, so I will combine them for brevity sake.

William M., aged forty-five years, boilermaker, engaged most of the time in repairing boilers in factories. When working gets very hot, as most of the time the fires could not be raked long enough to let the boilers cool. Has been in the habit of going out in the cool air at such times without covering over the shoulders. First noticed trouble one month ago.

R. S., aged eighteen years, chief clerk in railroad yard. Works in all kinds of weather. Carries large book on left arm, and turns pages and writes with the right hand. Has noticed shoulder was not right for three and a half months. Previous treatment, gymnastics. In both of these cases the muscles affected were those of the right scapular. The family histories are good in both cases, with the exception of rheumatism.

Subjective symptoms. Arms get tired very quickly; inability to move them just at the time and in the exact direction desired. Pain over acromian process very intense.

Objective symptoms. The scapulæ dislocated upward, inward, and backward. Reaction of degeneration in serratus magnus, rhomboidei, and (slight) in latissimus dorsi. Atrophy of shoulders and surrounding tissues. Scarcely able to extend arms in front even for a short time. When arms are raised above the head they can be kept there for some little time; more, however, by balancing than muscular action. Both cases treated with iodide of potash, galvanism, and the continued use of this brace. As soon as the brace was applied both were able to return to work in comparative

comfort. The improvement was continuous, and after six and nine months respectively both cases were completely recovered, and the brace was removed. Saw the cases two years after the treatment had been discontinued, and there was but little difference in the scapular region. Neither patient had lost a day from work on account of the old muscular trouble. These cases were to me interesting from the fact that I had never seen any cases of peripheral neuritis as plainly marked as these, and on account of being able to control the position of the scapula as accurately as this brace will do. To make the brace the patient is laid on his face and the arm placed in a position so as to produce the greatest deformity in the scapula. A circle of stencil board large enough to include the entire scapula is placed around it after the parts have been thoroughly lubricated. Into this receptacle is poured a mixture of plaster-of-Paris and water about the consistence of cream. After the plaster is thoroughly hardened a counter mould is made from it. By means of this mould is shaped the gutta-percha splint which is to hold the scapula in position. After the gutta-percha is covered with soft leather, on the back is placed a piece of thick sole leather, and attached to the outer border. This is for the purpose of bringing the pressure of the splint to bear upon the posterior border and inferior angle of the scapula. To the inner edge of this sole leather are attached three straps, with corresponding buckles on the shoulder-piece for the opposite shoulder. The outer edge of the sole leather is attached directly to the shoulder-piece corresponding to the dislocated scapula. The shoulder-pieces are simply broad pieces of leather long enough to reach nearly around the body, with holes for the arms and moulded slightly to fit the shoulders. They are joined together in front by three straps and buckles, just as behind. The object of having the three straps attached to the sole leather behind is so that, by shortening, the inferior angle of the scapula may be brought forward, and in this way completely controlled.

Mrs. M. C., aged twenty-six years. First seen May 27, 1889. Family history good. In December, 1888, jumped from a wagon, allighting on the ball of left foot. Felt sharp pain through foot. This continues up to the present time, having become more severe with each month. Has been unable to walk without crutches.

Present condition: Severe pain along course of plantar nerve; some pain, though not so severe, up the front of leg and in thigh. Has had no treatment but rest. Muscular response very weak, but normal. Atrophy present, but not very marked. Measurements give: left calf, one inch; lower thigh, one-quarter inch; and upper thigh one-half inch smaller than right. Foot swells, and is very red and very painful. Treatment: galvanism descending through sciatic, tonics, massage, and iodide of potash. *June* 10, 1889: Calf has gained one-quarter inch. Foot is swollen only in the morning. Reaction of muscles and legs stronger. Sensation good. There has been some sensory disturbance, though not very marked. *June 15th:* Less swelling and but little pain. Can walk comfortably without crutch. *June* 30, 1891: Returns to-day in good condition, walks without support of any kind, and is perfectly free from pain. One-quarter inch difference in calf and thigh. With this exception is perfectly recovered.

DISCUSSION.

Dr. R. H. Sayre asked if the scapular brace enabled the man to use his arms more comfortably, and if it held the scapula in good position while he was at his work.

Dr. Hodgen replied that the brace acted admirably in both of the cases. One of the men was a boilermaker, and was required to lie on his back most of the time while at work, yet even in this trying position the brace kept the scapula in good position.

Dr. A. M. Phelps asked for the author's explanation of the adduction following the fracture.

Dr. Hodgen said he had never heard of a case in which such a marked degree of adduction occurred so long after the injury. In his case it did not appear for two years; then it was quite rapid in its development, but was not attended by pain or discomfort.

EXTREME ADDUCTION OF THIGH.

By H. HODGEN, M.D.,
ST. LOUIS, MO.

As the subject of this deformity has not been able to return, on account of sickness, the report of this case will not be complete.

In October, 1885, Mrs. F. K., aged about twenty-five years, was thrown from the step of a car, falling upon the right knee. She was seen two hours after, and found to have intra-capsular fracture of the neck of right femur. The patient was nursing a three-months' old child, which probably accounts for the fracture, as the fall was not a hard one. The treatment was suspension with extension on double inclined plane. Six months after she sued the rail-road company. Examined at this time by experts appointed by court. Report of the examination, one-half inch shortening, with position good for such a fracture. At this time patient could walk very well with cane to steady herself. Two years afterward noticed that the leg was getting short. Was examined by her physician, who reported the joint ankylosed in deformed position. I saw her for the second time early this spring. The leg was apparently four and one-half inches short. When the left leg was straight and the right leg parallel to it, the right side of the pelvis was very much elevated. The right foot, when standing, could not be placed on the floor except by bending the left very sharply. The result of examination showed that the right leg was one-half inch shorter than the left, and that the apparent shortening, with the exception of this one-half inch, was due entirely to the adduction. The adductor muscles were extremely tense, the others were flaccid. I put the patient to bed and applied extension on both in the line of the leg, also lateral. The extension was kept up continuously for six weeks. At the end of that time there was no improvement in

the position. Under chloroform the thigh could be brought into normal position without much trouble. Motion very fair. After recovering from chloroform the leg was found to be in its deformed position as before. Advised section of adductors. The electrical examination showed reaction of degeneration in abductors and in nearly all the muscles of the thigh, spastic contraction of abductors, exalted knee clonus, impairment of sensation throughout the entire leg. Patient was to have returned after a few weeks for operation, but failed to do so. After section of tendons I should have kept the patient in bed and used an abduction apparatus. I am told the patient's mother was also lame from a fractured thigh. She also at one time had a slight adduction, causing an apparent difference of one-half inch in the length of the legs. After I heard that the patient would not be able to return for some time I advised the wearing of a high-soled shoe on right foot in hopes that this would overcome the deformity, as it had done in the case of her mother. I have heard nothing more from the patient, and do not know whether the advice was followed, nor the result. This is a result which I think does not often follow intra-capsular fractures of the neck of the thigh.

AN EASY WAY TO HOLD THE OPERATED-ON CLUB-FOOT IN THE CORRECTED POSITION WHILE THE PLASTER-OF-PARIS SPLINT SETS.

Illustrated by Photographs.

By HARRY M. SHERMAN, M.D.,
SAN FRANCISCO, CAL.

This apparatus was devised to avoid the difficult task of holding by manual force the freshly operated-on foot in position while the generally used plaster-of-Paris splint hardens.

After a forcible correction by the hands or by the wrench my own hands become very tired, and if I then go on and hold the foot in the corrected position while the plaster-of-Paris splint sets, I become unfitted for doing, on the same morning, any other operation requiring special delicacy or accurately directed force. This has been an annoyance to me, for, operating at a children's hospital, and chiefly on tuberculous patients, I have made it a rule to do my talipes and other non-tuberculous cases first, and follow them with the tuberculous. By the aid of this device the unutterably tedious task of holding the foot with the hands while the plaster sets is avoided.

The apparatus consists of a hard wood plank, twenty-seven inches long, twelve inches wide, and one and a half inches thick. It is pierced with holes, one inch in diameter, distributed regularly over the board one and a half or two inches apart. There are also four or six pegs six inches long, and carefully turned so that the lower ends accurately fit the holes in the board, while the upper ends are notched to receive and hold the loose ends of muslin bandages.

To use it, the foot in its still soft plaster-of-Paris bandage is placed, toes up, on the board; a loop of bandage—ordinary unbleached muslin bandage—encircles the ankle, crossing over the outer malleolus

and passing from the front and back to a peg situated a couple of inches from the foot and about on a level with the sole. A second

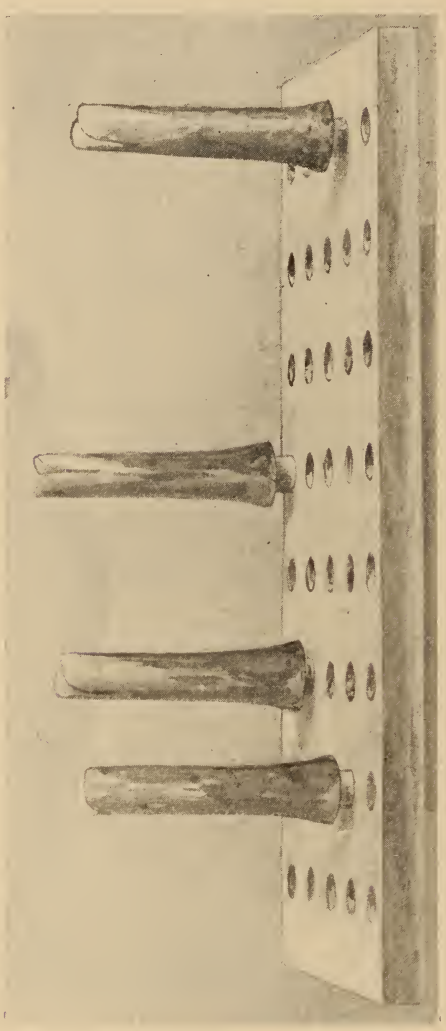


FIG. 1.

An easy way to hold the operated-on club-foot in the corrected position while the plaster-of-Paris splint sets. The apparatus.

bandage is disposed as follows: It starts from a peg a couple of inches away from, and on a level with, the outer malleolus; it crosses the point of the heel, from without inward, passes forward along the

instep on the inner side of the foot, crosses over above the bases of the toes and around underneath them to the inner side of the first

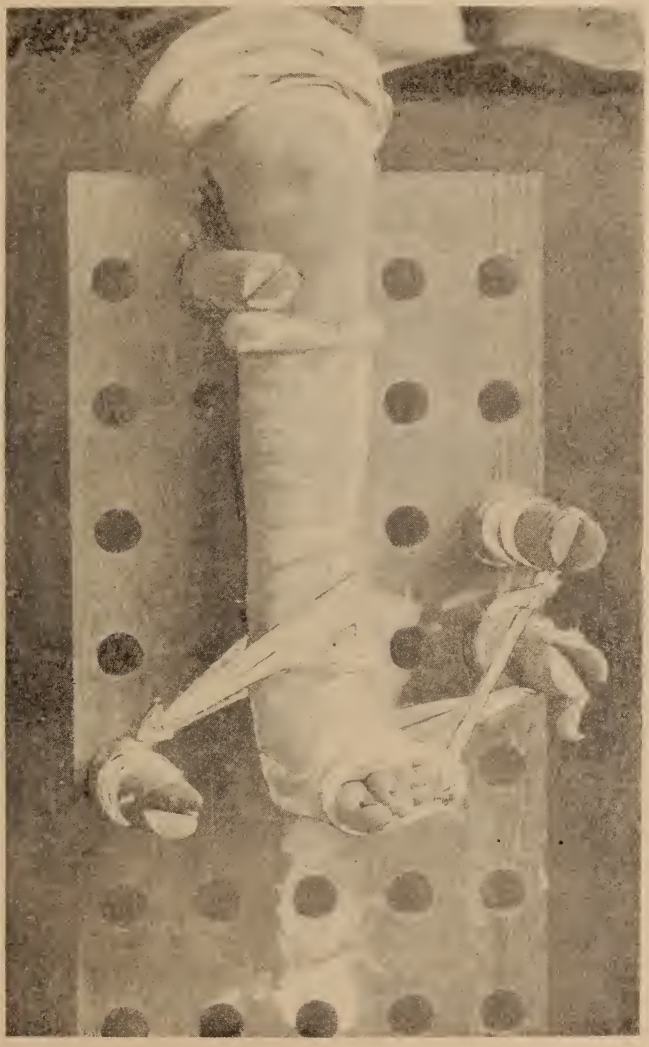


FIG. 2. Bird's-eye view.

metatarso-phalangeal articulation, when it encircles that portion of itself coming from the heel forward, and returns across under the

FIG. 3.

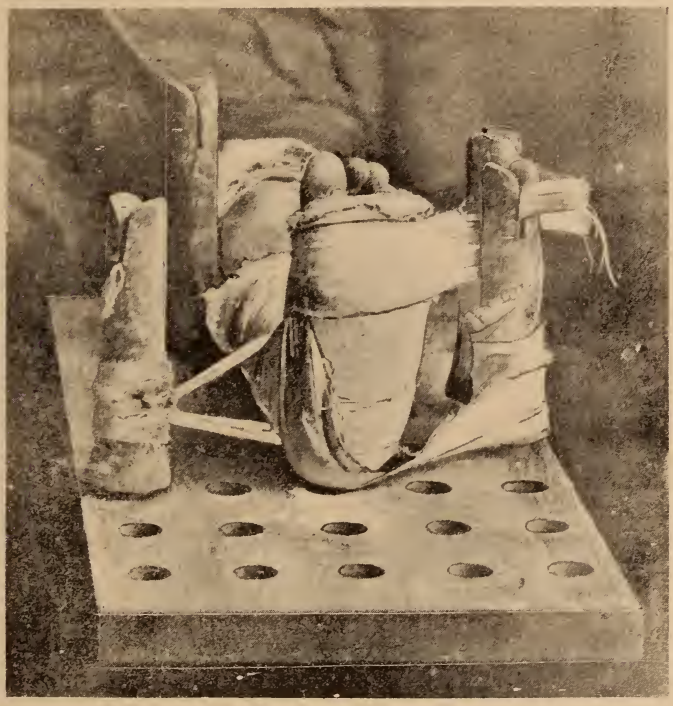
View of inner side.

FIG. 4.

View of outer side.

metatarso-phalangeal articulations, and from the outer edge of the foot it passes upward and outward to a peg situated about two inches from the leg and nearly as high as its middle. A fourth peg is put close to the leg and just below the internal tuberosity of the tibia. With this disposition of the bandage the circulation of the foot is in no way interfered with. By twisting the pegs, and so tightening the

Fig. 5.



View of sole.

bandage, the foot can be everted, abducted, and flexed to any desired extent, and then held there until the plaster has hardened.

The apparatus which I have endeavored to describe is not only very convenient at the time for which it was originally intended —immediately after an operation—but I have also used it with satisfaction in the gradual correction of an acquired talipes, the foot being pulled, in its soft plaster splint, into a position corrected as much as the non-anæsthetized child could stand, and held while the plaster

hardened, and this repeated at intervals of a week, or ten days, or a fortnight, until the deformity had been both corrected and over-corrected.

I never have had a pressure-sore under the splint after the use of this apparatus, not even over the outer ankle where the pressure is greatest. Unless the foot is so forcibly twisted that, from the tension of the tissues the circulation is obstructed, there need be no swelling of the foot inside the splint; I have but once had this happen to me.

Colloquially, we call the apparatus a "cribbage-board."

ETIOLOGY OF CLUB-FOOT.

By SAMUEL KETCH, M.D.,
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It is not intended in these remarks to consider the etiology of acquired club-foot, as this class of cases has been sufficiently well studied and the etiological factors are well known. Quite different is it with the congenital variety.

At the present day the theories relating to the etiology of congenital club-foot may be placed under the following heads:

1. The theory of pathological changes affecting the child *in utero*.
2. The theory of heredity.
3. The theory of mechanical forces acting on the fœtus.
4. The theory of arrested or obstructed development.
5. The theory of non- or retarded rotation.

Concerning the first theory advanced, which had for its most earnest advocate Little, and who depended largely in proof of this idea on the similarity of the deformities produced in the congenital and acquired forms, no direct testimony has been brought forth. It is true that in the acquired variety the appearance of the deformity is very much like that seen in the congenital form; but aside from this similarity it has not been proven that a fœtal myelitis or a meningitis takes place, nor has the microscope demonstrated lesions in the fœtal brain or cord, such as occur in infantile spinal or cerebral paralysis.

Again, functionally, there is a decided difference in the two forms. In the congenital form volition is not affected except mechanically, due to altered relation of parts; the electrical reactions are maintained intact, the contour of the part is not altered, and the foot has a normal surface temperature. We find diametrically opposed to this the condition of the acquired club-foot: loss of power, atrophy,

low surface temperature, and markedly changed electrical reactions are always present.

Heredity, while undoubtedly entering as an etiological factor in cases of club-foot, is not a constant or so frequent an element in causation as sometimes assumed. In an analysis of 196 cases of congenital club-foot to be hereafter appended, only 10 cases gave unmistakable evidence of hereditary influence. In none had the father or mother club-foot. In 1 case the maternal grandfather; in 4 cases, uncles; in 3 cases, brothers of patient; in 1 case a sister; in 1 case a cousin; and in 1 case another child in family (sex not mentioned) had club-foot. The absence of club-foot in parents in my series of cases does not, of course, disprove the occasional direct transmission of this personal configuration, for many such cases are on record; yet I believe the proportion of hereditary cases too small to give heredity more than a limited etiological significance.

It might not be out of place in this connection to say a word regarding maternal impressions in relation to club-foot. In this, as in all congenital deformities, the surgeon is informed of remarkable coincidences occurring during the pregnant condition. In regard to these impressions it has been shown in many cases that at the time received the parts involved had already been too far developed to be affected by the (nervous?) condition. Still, many instances are very striking. The general consensus of opinion does not attach much importance to their causative influence. In the 196 cases already mentioned, 14 mothers had distinct maternal impressions. These were of various kinds, but I will not weary you with their recital.

The third theory, that of mechanical forces acting on the fœtus, or the pressure theory, has had the largest number of adherents. Here it is maintained that there is a lack of amniotic fluid, and that as a consequence of this there is a permanent fixation of the fœtal foot by the faulty intra-uterine pressure. Primarily, it is argued as against this theory, that in the earlier months of intra-uterine life, before the fourth or fifth month, when the amniotic fluid is plentiful, and where no intra-uterine pressure occurs, that the deformity is already present.

Again, other parts which would be subjected to the same pressure are not found deformed at birth. It is a well-known fact that coin-

cident deformities are not abundant, and in the 196 cases I have analyzed, only 8 showed the presence of other malformations. Furthermore, it has been shown that at the birth of children with club-foot no appreciable difference in the quantity of liquor amnii, judging from previous labors, could be ascertained, and Duval states that the reverse is true in the cases observed by him.

The theory of arrested or obstructed development has of late found its most enthusiastic advocate in Bessel-Hagen. Previously many authors had described changes in the tarsal bones, principally the astragalus and os calcis, and none more thoroughly than Adams and Hueter. Volkmann divided these cases of arrested development into two classes: First, primary or idiopathic; secondly, secondary. Bessel-Hagen has in his studies endeavored to prove by anatomical investigations the occurrence of primary congenital club-foot due to either an abnormal tendency of the germ itself or to an arrest of development, and describes the anatomical condition of the parts as shown in the embryo. He classes amongst club-feet due to arrest of development cases where there is also an accompanying club-hand due to defective radius, and dates the occurrence of these cases of arrested development to the very earliest portion of embryonic existence, when the formation of muscles, tendons, and articulations take place.

In opposition to the generally accepted idea that the normal position of the embryonic foot was one of supination, Bessel-Hagen states that the foot is essentially extended and to a high degree plantar-flexed, and is in opposition to the idea of a physiological club-foot stadium. His researches with fresh specimens show the embryo of 30 mm. to have a straight foot; 30–40 mm., gently plantar-flexed; and from 90 to 100 mm., feet at right angles to leg and well formed. After this the form of the foot differs. It may be in a position of dorsal flexion, abduction, adducted, or supinated. He claims that it is only in the very last months of pregnancy that a supination takes place, and gives as reasons for this the lack of uterine space to the relatively decreased quantity of amniotic fluid, and to pressure. This supination, however, is not constant, and, as a rule, only appears (as observed by Scudder) when the development of the foot has been completed as to the adaptation of form to function; even then the supinated foot is dorsal-flexed;

and this disposes of the theory of Hueter, that the club-foot at birth is but a continuation of the normal or physiological club-foot. He also claims, in opposition to the studies of club-foot as made from specimens in jars, that the form of the foot is often determined by the vessel in which the specimen is kept, and has made his investigations entirely from fresh cases.

The cases regarded as secondary are described as being due to intra-uterine pressure or weight, and are simply the result of an abnormal action of mechanical forces on what was a normal fœtus. This secondary division has already been referred to under the head of mechanical forces acting on the fœtus *in utero*, and some of the arguments against the pressure theory adduced. Lately it has been assumed by Roser that no special pressure is necessary; and even where there is sufficient amniotic fluid, club-foot may arise by the foot striking the wall of the uterus obliquely during movement of the fœtus and so getting into a wrong position.

Again, Bessel-Hagen states that club-foot may be produced by the concrescence of the amnion with the surface of the embryo, the foot being thus maintained in an abnormal position, and cites instances where, after birth, amniotic bands and marks of spontaneous amputation appear. Also, that there is frequently insufficient room in the uterus and relative lack of liquor amnii. Unfavorable position of the embryo, faulty knee- or hip-joints, tumors of the uterus or vicinity, multiple pregnancy, and finally, abnormal growth (hydrocephalus) in the last part of pregnancy, may produce club-foot.

His idea, furthermore, is that club-foot may be developed at any time after the extremities appear, and in every period of embryonic life, which is directly opposed to Bangor, who claims that club-foot cannot begin before the fifth month; Kocher, who put it during the first half of pregnancy; and Parker and Shattuck, who assigned the formation of the deformity to the period in which the embryo is as yet incapable of all muscular action.

The theory of non- or retarded rotation, as first indicated by Eschricht, quoted by Billroth, and afterward elaborated by Berg, has for its foundation the assumption that at a certain time all fœtuses were club-footed, and Berg states that the position is either one of varus or equino-varus. Berg has gone into the mechanism of non- or retarded rotation very thoroughly, and describes the position of

the lower extremities at different periods of fœtal life. He showed that at an early period the whole leg is rotated outward, that this is accompanied by an exaggerated varus, and still later an equino-varus. This diminishes as the rotation to the normal position progresses; but he states that even when the rotation of the leg has been completed some of the varus still remains, and calls attention to the very slight varus of the newborn.

I have collected from the case-books of the New York Orthopedic Dispensary and Hospital 617 cases of club-foot under the charge of Dr. Newton M. Shaffer. Of these, 196 were congenital and 421 of the acquired type. I shall here only deal with the congenital variety. Of this type, 126 occurred in males and 70 in females. 87 cases gave deformity of both feet; 57 occurred in the right foot, 49 in the left. Location was not mentioned in 3 cases. 151 cases presented a condition of equino-varus; 3 cases presented a condition of equino-valgus; 14 cases presented a condition of pure varus; 2 cases presented a condition of pure valgus; 4 cases presented a condition of pure equinus; 16 cases presented a condition of pure calcaneus; 3 cases showed different forms in each foot; in 3 cases the variety is not mentioned.

This analysis bears out the researches of Adams and others, that by far the greater number of cases belong to the acquired variety, the proportion being a little over 2 to 1. It also shows the marked disproportion of the double over the single variety and of the greater frequency of the compound type of club-foot. Its greater frequency in males is also emphasized, and the right foot was found affected most frequently.

I have already had occasion to speak of heredity, maternal impression, and the occurrence of associated deformities; and in conclusion I hope that this short paper may be useful as a basis for opening a discussion on this mysterious but interesting subject.

AT WHAT AGE SHOULD THE FIRST TREATMENT OF CONGENITAL CLUB-FOOT BE INSTITUTED?

By H. AUGUSTUS WILSON, M.D.,
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The special feature of this meeting is the discussion of the treatment of club-foot, but such discussion would be incomplete without some consideration being given to the proper time for the first treatment to be instituted in order to be most efficacious. Notwithstanding the absence of any well-authenticated reason, and often in direct opposition to well-established facts, a vast number of cases still go on to maturity with uncorrected, relapsed, or only partially corrected feet. That this is due largely to misconception as to the proper time to begin treatment, as well as to apparent want of knowledge of what that treatment should consist, is clearly understood by all orthopedists.

The general practitioners, however, are often the ones who advise delay or overlook the necessity for appropriate treatment early applied and persistently continued. As accoucheurs, they are often the ones to direct the first treatment and decide as to the age at which it should be applied, and it is important, therefore, that they should be informed of the results of experience. In the table of 101 cases, reported by Dr. E. H. Bradford, in the *Transactions of the American Orthopedic Association*, 1889, vol. i. p. 89, the age at which the cases were first seen by him is given, as follows:

2 cases	at	4 weeks.
1 case	"	7 "
2 cases	"	2 months.
10 "	"	3 "
2 "	"	4 "
1 case	"	5 "

7 cases at	6 months.
1 case "	7 "
3 cases "	8 "
6 " "	1 year.
2 " "	1½ years.
1 case "	20 months.
10 cases "	2 years.
2 " "	2½ "
4 " "	3 "
11 " "	4 "
12 " "	5 "
6 " "	6 "
4 " "	7 "
1 case "	9½ "
1 " "	10 "
3 cases "	11 "
2 " "	12 "
2 " "	15 "
1 case "	18 "

The experience of others is similar to the above, and I have quoted Dr. Bradford instead of referring to my own case-book. An explanation of the delay, shown in the foregoing statement, may be found in the indefinite and often misleading statements of accepted text-books and writers on surgery from a few of which I quote. Ashhurst[1] says: "Mechanical extension should be resorted to in the third to fifth week; not before the third week. The best age for tenotomy is between the second and third month." J. B. Roberts[2] recommends "immediate correction by force, maintaining the position by gypsum bandage, and tenotomy after two months." Agnew[3] advises treatment "at an early period of life, but tenotomy not earlier than the fourth or fifth month." Fisher[4] thinks that the most favorable time for tenotomy is when the child is six weeks old. Morton[5] urges manipulation from early babyhood, but condemns tenotomy until the child is able to walk. A. S. Roberts[6] states that "mechanical appliances should always be granted a fair trial before resorting to operation." Milliken[7] considers the best

[1] Ashhurst: Prin. and Prac. of Surg., ed. 1885, p. 686.
[2] Roberts: Modern Surgery, ed. 1890, p. 736.
[3] Agnew: Surgery.
[4] Fisher: Internat. Ency. Surg., ed. 1888, vol. iii. p. 681.
[5] T. G. Morton: Trans. Amer. Surg. Asso., 1890, vol. viii. pp. 71–77.
[6] A. S. Roberts: Clinical Lect., Phila Hosp., 1886, Nos. 1 and 11.
[7] Trans. Amer. Orth. Asso., 1890, vol. iii. p. 50.

time to do tenotomy is when the child begins to walk, but advocates manipulation being instituted at birth. Professor Sayre[1] says: "If prompt treatment were the rule, section of the tendons would rarely be called for, but should be resorted to when necessary." Gross:[2] "Age is no bar to tenotomy." Druitt:[3] "The earlier tenotomy is done after other treatment fails, the better." Ewens:[4] "No educated surgeon of the present day would, I imagine, allow an infant to reach the age of three months without tenotomizing every contracted tendon or putting on suitable apparatus; but it becomes a serious question how far one would be justified in allowing a child to grow up beyond the age of three years, when it is evident that the bony deformity is so great as to defy rectification by free tenotomy." Bryant[5] recommends manipulation and strapping a few days after birth, and tenotomy when necessary; has operated at one week. Stephen Smith:[6] "Treatment as soon after birth as possible." Wyeth:[7] "All forms should be treated from birth, and tenotomy determined by degrees of resistance." Moullin[8] urges treatment to begin in infancy; tenotomy, if manipulation, etc., fail. Schrieber:[9] "As early as possible." Parker:[10] "It may be laid down as a canon that treatment should commence immediately after birth, and that tenotomy is an essential feature of the treatment of many cases." Pye:[11] "I believe that it will be found much speedier and a more satisfactory plan to recognize from the first that early tenotomy will give the best results." Bradford:[12] "Treatment should be begun as early in infancy as possible; the amount of time gained by tenotomy is not great." Vance[13] begins treatment about the tenth day by manipulation and retention

[1] L. A. Sayre: Trans. 9th Internat. Congress.
[2] S. D. Gross: System of Surg., ed. 1882, vol. ii. p. 1036.
[3] Druitt: Modern Surg., ed. 1887, p. 491.
[4] John Ewens: Brit. Med. Journ., Oct. 17, 1891.
[5] Bryant: Prac. Surg., ed. 1884, p. 817.
[6] Stephen Smith: Operative Surg., ed. 1887, p. 824.
[7] Wyeth: Text-book on Surg., ed. 1890, p. 811.
[8] Moullin: Treatise on Surg., ed. 1891, p. 355.
[9] Schrieber: Wood's Med. and Surg. Monographs, vol. ii., No. 3, p. 807.
[10] Parker: Congen. Club-foot, ed. 1887, p. 85.
[11] Pye: Surg. Treat. Common Deformities of Children. 1889.
[12] Bradford: "Treat. Club-foot," Trans. Amer. Orth. Asso., 1887, vol. i. p. 89.
[13] Vance: Discussion, Trans. Amer. Orth. Asso., 1889, vol. i. p. 115.

apparatus, and when that is not satisfactory divides the tendo Achillis.

H. Hodgen[1] believes, in the majority of cases, in cutting the tendon and rectifying at once, not taking time to stretch it. Steele:[2] "If they can be corrected without cutting, it would be far better." Keen and White:[3] "The earlier the deformity is corrected and the foot held in the right position, the better; time may be saved by tenotomy."

A plan of treatment appropriate to one case or class of cases is often inadequate in others, and therefore treatment, when referred to in this paper, will mean the thorough correction of the deformity, its proper maintenance, and the application of measures having for their object the full establishment of the functions of the foot. In whatever degree the deformity may exist, attempt should be made at the earliest possible moment after birth to correct the deformity. The first day is none too soon, in my opinion, and the longer the delay the more difficult will be the recovery. In no case should plaster-of-Paris or fixed and immovable apparatus be kept on for more than one month, for their continuance tends to produce muscular atrophy. In all cases, passive motion, gymnastic exercise, friction, and the encouragement of motion in proper directions should be early instituted and persistently maintained. In all cases the form of apparatus selected should make elastic, in preference to rigid retention, to enable the patient voluntarily to move the foot in the proper direction, but upon the cessation of muscular effort to restore it to its normal position. In cases of first degree, or where the deformity is easily corrected and easily maintained, operative procedure is rarely, if ever, necessary in infancy. In cases of second degree, or where the deformity is corrected with difficulty, and where considerable restraining force is required, it is often desirable to cut, through an open wound, every soft tissue that restrains complete restoration rather than depend upon their possible stretching under force. The first day is none too soon to resort to such operative procedures, but any time during the first month will usually suffice. In cases of third degree, or where correction

[1] Hodgen: Discussion, Trans. Amer. Orth. Asso., 1889, vol. i. p. 115.
[2] Steele: Discussion, Trans. Amer. Orth. Asso., 1889, vol. i. p. 115.
[3] Keen and White: Text-book of Surg., ed. 1892, p. 342.

cannot be accomplished without the employment of great force, more extensive operative procedures are necessary, and should be resorted to only after failure of tenotomy. In some cases I believe that early removal of the astragalus will enable the patient to adjust the muscles to the new circumstances and assist in developing them? The earliest age at which this is proper, in my estimation, is between the ages of one and two years. In cases that have been without treatment in infancy, or have relapsed, numerous operations have been recommended and resorted to, the consideration of which is inappropriate in this paper.

I contend that it is not rational to wait until the doubtful assistance of walking can be procured, because I believe that it is clearly proven that the earliest moment at which the deformed foot is thoroughly corrected the more satisfactory will be the ultimate result. During the period of one year or more spent in waiting for the child to walk, the muscles will have adapted themselves in part to their abnormal positions; some will have become inactive, and others overactive. This ultimate result, however, depends upon the completeness of the first correction, and as well upon the efficiency of the maintenance of the corrected position and the establishment of correlation of muscular forces. Relapses are the inevitable result of inefficiency on the part of those having the care or direction of the institution of the first remedial measures employed, and one of the prominent factors in these cases I have found to be delayed early correction. While it is improper to say that in all cases operative procedures should be resorted to or refrained from, I firmly believe that the rule should be adopted, and without exception, that complete correction should be accomplished at the earliest possible moment—during the first month, if possible; and that this correction should be accomplished by the employment of every rational means—let it be operative, mechanical, manipulative, or gymnastic—but it must be complete to be effective. I believe that the soft bones of the tarsus will alter their shapes as they are squeezed and compressed by force, and leave the shortened tendons as much contracted as they were before, because we know that tendons rarely, if ever, yield, except by tearing, while cartilaginous bones, not yet ossified, will yield to pressure. I believe that on making an examination of many feet corrected without opera-

tion, but where operations were indicated, that no elongation of the tendons would be found, but an altered external appearance of the foot, due to the softened condition of the bones, their being squeezed into an external appearance of correction. I believe, therefore, that at the earliest possible moment we should employ any method which will be necessary to correct deformity and which will prevent a return to the deformed condition. In reality, the first correction, no matter by what means accomplished, is but the means to an end. It is not only correcting the appearance of the deformity, but it is the correction of the mechanical defects, so that the mechanical functions may be reëstablished. The production of muscular atrophy, which is so serious an obstacle to correction of club-feet after the period of infancy has passed, is a profoundly interesting subject, and I have but to refer to Chinese ladies' feet for evidence of what is too often done with club-feet. The long-continued use of mechanical correction or restraining apparatus of any kind that does not provide for free ankle motion will accomplish, just as successfully as the foot-binder, a muscle atrophy. This muscle atrophy is in turn followed by atrophy of the bones, not only in their diameter, but in their length as well. The natural tendency of a congenital club-foot is toward atrophy from disuse and increased deformity, and, therefore, we are warranted in resorting to every means to avoid its occurrence. The certainty with which muscle atrophy is corrected by judicious means clearly indicates that if it cannot be entirely prevented in congenital club-feet, it can, at least, be arrested and controlled. The length of time required to accomplish a full and complete correction of a congenital club-foot is the same as that required to form the foot of a normal child, and depends upon the age at which correction was obtained and the efficiency of remedial measures employed. Not until the normally formed child is ten or twelve years old does the foot possess the normal conditions necessary for its full usefulness. All babies are flat-footed, many are pigeon-toed; but all of these conditions pass off as soon as the correlation of muscular forces establishes the mechanical functions. The same may be said of a child born with a club-foot, certainly in the milder forms, that until the age of ten or twelve years the correction must be maintained mechanically, and efforts must be made to develop the muscular system; the

longer the delay in establishing the normal functions the less likely will those functions be normal.

That which in the normal child prevents the foot from becoming deformed, although it may be placed temporarily in a deformed position, is the correlation of muscular forces, and this must and can be established in cases of club-foot that are corrected sufficiently early. The absurdity must be avoided of resorting to gymnastic forms of treatment, and at the same time destroying their efficiency by the use of mechanical restraining apparatus that not only prevents the reproduction of the deformity, but at the same time restrains all motion. Thus I have seen rigid plaster-of-Paris and rigid steel braces in constant use in cases where it was removed every day for half an hour, and during that time developmental methods employed. The trivial gain by manipulation was irrevocably lost by the employment of an apparatus which kept every part of the foot immovable. To accomplish a complete recovery there must be an understanding of the mechanical functions to be recovered, and this is apparently absent in those who postpone the application of rational treatment, or simply cut tendons, and allow the case to relapse by neglect, or who consider braces to be curative.

The diversity of views as to the existence at birth of bone malformations will account in part for the existing differences of opinions as to the propriety of resorting to operative procedures early in infancy. Druitt[1] believes that in some cases the astragalus is quite normal, proving that bone-changes are not necessary to talipes. Erichsen[2] says very little alteration has taken place in the condition of the bones. Power:[3] "I am, therefore, led to suppose that the deformity is due entirely to bone-changes." Ashhurst:[4] "In most cases bones of the foot are not altered in structure." Adams[5] maintains that in cases of varus the astragalus is malformed from the moment of birth. Morton:[6] "Bones, especially the astragalus, are greatly deformed and unrecognizable after excision." Phelps:[7]

[1] Druitt: Modern Surg., ed. 1887, p. 491.
[2] Erichsen: Science and Art of Surg., ed. 1884, p. 579.
[3] Arcey Power: Trans. Path. Soc., London, 1888–89, xl. p. 248.
[4] Ashhurst: Prin. and Prac. of Surg., ed. 1885, p. 686.
[5] Adams: Amer. Surg. Asso., 1890, viii. p. 71.
[6] Trans. Amer. Surg. Assoc., 1890, vol. vii.
[7] New England Med. Monthly, February, 1891.

"Deformity of the soft parts out of all proportion to the deformity of bone."

I am convinced that to a very large extent the changes in the structures of the bones, often described, is due in a large measure to postponement of appropriate treatment. This may be accounted for in either of two ways: First, that observed in uncorrected cases where the process of ossification progresses and the partially dislocated tarsal bones become permanently deformed to suit the abnormal position of the foot; and, secondly, in those cases of more or less marked severity where recourse has been had to mechanical force to stretch shortened tendons. The bones in these cases, whether deformed or not, yield to the pressure exerted and thereby become deformed and become ossified in their altered shape.

In most instances either of these occurrences could and should have been avoided by the early recourse to operative procedures. It is not a question of saving of time, but of perfect correction. In conclusion, I would offer the following:

That full perfect correction should be obtained during the first month.

That where correction is possible without recourse to rigid restraining apparatus, tenotomy should be avoided.

That tenotomy, syndesmotomy, or cutting of fascia, should always be resorted to in the first month, when perfect correction cannot otherwise be maintained without employing undue force.

That tenotomy should never be resorted to in infancy without being followed by developmental as well as restraining treatment.

That it is misapplied mechanics to force a club-foot into a rigid restraining shoe, and that doing so in the first months of infancy will produce ultimate bone deformity.

That all apparatus employed in infancy should facilitate free motion in the proper (*i. e.*, normal) direction, and encourage the development of correlation of muscular force.

All methods which employ undue force in correcting or restraining club-feet should be refrained from until the child reaches the age when the bones are completely ossified. The same period should be awaited before resorting to operations upon the bones.

DISCUSSION.

Dr. Roswell Park said that in view of the fact that the orang-outang habitually walks on the outside of the foot, or in a position of talipes equino-varus, this congenital deformity would seem to be a species of atavism.

Dr. Samuel Ketch said that the chief object of his paper was to invite discussion on the etiology of club-foot. Hoffa refers to the theory of atavism, and speaks of talipes as the remains of the time when the feet were used not only for locomotion, but principally for prehension. Personally, he did not believe any one theory would account for all cases of club-foot; probably a combination of the theory founded on Wesselhagen's investigations and the theory of non-rotation, or of retarded rotation, will explain all the cases. Equino-varus must be the most easily produced, for it is by far the most common.

Dr. Park said he did not pretend that all cases could be explained by the theory of evolution, and he had only alluded to it as being another example of the tendency to revert to a more primitive type, just as is seen in other parts of the body, and, almost without exception, the various deformities are susceptible of such a classification.

Dr. A. M. Phelps said that he had on a previous occasion exhibited at the Academy of Medicine a number of specimens of club-foot, showing the deformity at the sixth, seventh, and ninth months of intra-uterine life, and the fourth, fifth, and sixth years after birth. The intra-uterine foot showed no deformity of the bone, but the greatest deformity before removing the skin; whereas in other cases where there was much bone deformity, very little was visible before removing the skin. If the evolution theory were correct, how is this occurrence explained? Such cases must be due to spasm of muscle, or to intra-uterine pressure, or something of that kind. He had a specimen of varo-equinus and varo-calcaneus occurring in

the same subject, which showed what seemed to be the contour of the uterus as it had pressed upon the feet.

Dr. C. C. Foster, of Cambridge, reminded the Association that it was not infrequent to find a contracted skin under the instep offer a very serious obstacle to the reduction of an equino-varus.

Dr. B. E. McKenzie had seen quite a number of cases in which several of the members of a family had club-foot. This did not necessarily prove heredity, as it was susceptible of explanation on the ground that there was some peculiar formation of the mother which resulted in intra-uterine pressure. While, in a general way, he accepted the theory of evolution, he looked to non-development as the chief causal factor in club-foot. Dr. Park's reference to hare-lip would not substantiate the evolution theory, for it was known positively that hare-lip is due to a failure in the perfect development of the individual.

In answer to a question, he said that in the family where there were three cases of deformity, there were altogether thirteen children, the others being perfectly developed. The three cases of deformity did not follow each other in succession.

Dr. W. E. Wirt, of Cleveland, Ohio, said that where there is a reversion to the primitive type, it is associated with a greater muscular development, whereas in club-foot the contrary is true.

Dr. Park remarked that the occurrence of several deformities in one family seemed to him to be an illustration, not of heredity, but of atavism.

Dr. A. J. Steele agreed with Dr. Ketch in believing that different cases of club-foot have different causes. He had under observation a case of double club-foot in which there were six toes on each foot; the toes were webbed, and there were also anomalies of the hand.

Dr. Ketch, in closing the discussion, said that Dr. Phelps seemed to consider the primary fault to be in the soft parts, but it had been

proven that even before there is any condition which can be considered as a "physiological club-foot," there is a blasting of the embryo, resulting in a lack of development of one part of the body. Personally, he had not found any direct proofs of heredity. He could not see how evolution played any part in the production of club-foot, inasmuch as it had not been proven that at a remote period the apes were club-footed. Regarding changes in the bone, Adams had found such changes at birth in every case which he had investigated.

Dr. A. M. Phelps exhibited a little girl, seven years of age, who had been sent to him by Dr. Ridlon. It was a very severe case of congenital club-foot, and had been under Dr. Ridlon's observation since she was three months old. He had performed tenotomy when she was about one year old, but shortly after that he had lost sight of the case for a long time. On the 15th of May last, the speaker had performed the open operation, and after the exercise of great force—probably two hundred pounds, at least—he succeeded in restoring the foot to a proper position. Unless all resisting structures are cut—even nerves and bloodvessels—relapses will occur. After the deformity had been corrected, the foot was enveloped in a plaster-of-Paris dressing and held in position until the plaster had thoroughly set. The first dressing was changed at the end of three or four weeks, and at the next change of dressing a nicely fitting shoe was applied, and was worn for two months, after which she was allowed to go around with a plaster-of-Paris casing.

MANUAL REPLACEMENT IN THE TREATMENT OF CLUB-FOOT.

By AP MORGAN VANCE, M.D.,
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Mr. Chairman and Gentlemen: At our meeting, four years ago, at Washington, when the subject of club-feet was under discussion, I remember Dr. Willard and myself were the only members who claimed anything for manual replacement as a remedy; the Thomas twister, Morton's crusher or traction, with or without tenotomy, being advocated by the others present. I had up to that time had only a few cases upon which I had tried this method of complete replacement under anæsthesia, and by the aid of all possible tenotomies. Since then I have had many cases, and feel more enthusiastic over the rapid results obtained than ever; as with each new case I am able to discover some new way of grasping the foot, or new position in which I can better utilize the edge of the table or padded block.

For a long time I found it difficult to do as well with the left as I could with the right foot, as the latter would be more awkward to handle, and I could not exert as much force as was needed. I soon learned, in endeavoring to overcome this disadvantage, that all that was needed was a little more time and a prolonged effort, rather than the very rapid replacement that was possible with the right foot; that is, I found I could gradually tease the foot to the improved position by a longer and more patient manipulation, instead of at once crushing it. In a small proportion of cases, where the patients were older, the rapid replacement would result in complete tearing of the integument corresponding to the incision in Phelps's operation. In all extreme cases a superficial necrosis or blistering of the skin on the inner side of the foot would occur, but I have

had no trouble from this, nor from the open wounds mentioned above, as an antiseptic dressing was carefully applied under the plaster boot. There is never any of the deeper sloughing that sometimes follows the use of the "twister."

It is very remarkable to what severe treatment a child's foot may be subjected without any evil resulting. This fact was impressed upon me many years before the introduction of these crushing operations, while practising manipulation during the process of gradual traction after tenotomy, as practised at the Hospital for the Ruptured and Crippled while I was there as interne; we would invariably pair off cases of club-feet and get up a rivalship between two boys or two girls, and it is very remarkable how much violence they would stand, and how little they were inconvenienced by it; submitting to treatment twice a day and never ceasing their play or in any way suffering from the severe usage. Even after an operation, as practised now, only a few doses of opium are needed, and it is found difficult to keep them quiet long enough to allow the plaster boots to dry, and to insure against too much use after the multiple tenotomies.

I have often had cases walk in the boots four or five days after the complete correction of an extreme talipes equino-varus, seemingly without pain or any great inconvenience. It would be interesting to know just what amount of change is produced in the structures of the foot. I am very sure that the tarsal bones are either broken or immediately changed in shape by the compression. In one case only have I broken the bones of the leg, an extreme case of equino-varus in a boy aged seven years, where a former phlegmonous inflammation followed an unskilful tenotomy, and the tissues were matted together and unyielding; the tibia and fibula gave way just above the epiphysis. In this case a very much more rapid, and also a very perfect, result was obtained, as the extreme inversion of the foot was at once corrected by rotation of the lower fragments and the careful application of a plaster splint.

I have found that the older the child, up to ten or twelve years, the better the result, simply because a better grasp can be obtained, and the retention in the new position is more easily maintained than is possible in the softer, smaller, and more yielding feet of younger children. The tendency to relapses is much less than after gradual

correction. I suppose this is partly due to a deposition of plastic material, or an organized clot may form in the spaces produced by the changed position of the bones.

Instead of years, as is often needed to accomplish a cure by the old methods, only weeks or months are necessary by this; after the first week or two the ordinary club-foot shoe is substituted for the plaster boot, and worn until the foot does not show any tendency to relapse. I advise the brace to be worn at night for a long time after the cure seems finished in all of these cases. In the older children who have walked much, large bursæ are always present. I believe it is just as well to do the operation at once as it is to treat the bursæ before. I have practised both methods, and found the one as satisfactory as the other. This practice would hardly be safe with the Thomas twister or Morton instrument.

THE TREATMENT OF CLUB-FOOT BY CONTINUOUS LEVERAGE.

By HENRY LING TAYLOR, M.D.,
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In a paper written for this Association and published in its *Transactions* for 1889, and in the *Medical Record* (March 8, 1890), the writer described and advocated a method of treating pes equino-varus by leverage continuously applied in such a manner as to progressively unfold and re-mould the deformed foot. The following practical points in the treatment were emphasized:

1. The preservation of the heel-cord as an aid in unfolding the foot.

2. The reduction of the varus deformity first, afterward of the equinus.

3. Exact prehension of the foot by an apparatus not attached to the shoe, and by adhesive plaster applied to the leg.

4. The application of leverage to the inner side of the foot and leg.

5. Thorough mechanical after-treatment.

If, in equino-varus, the deformed member is viewed from behind, the foot and leg are seen to constitute an irregular curve with the concavity inward. The plan is to efface this curve and throw the foot into the valgus position by applying a lever to the inner side of the foot and leg, where it can act most directly and efficiently. In the case of an infant this can readily be done by means of a wooden splint or light strip of metal, padded, and bent somewhat less than the curve to be acted upon, and securely strapped at the ends to the fore part of the foot and to the leg below the knee, while the ankle is drawn toward this lever by a third strap placed a little above that joint. As the foot yields to the leverage thus

applied the lever is straightened, and the process is continued until complete eversion of the foot is obtained. After the original curve formed by the inner border of the limb has been considerably reduced by this process, the anterior part of the foot is turned outward, and in place of the single inner concavity we have two—the upper, formed by the os calcis with the tibia; the lower, by the os calcis with the metatarsus; the exaggerated concavity of the sole forms a third abnormal curve. When this stage is reached the splint should be well padded opposite the os calcis, so as to engage it and pry it over into place; since the position of the os calcis is finally the key to the situation. No effort has been made up to this point to correct the equinus element of the deformity.

"In equino-varus the tendo Achillis is inserted toward the inner side of tuberosity of the os calcis, and the inner border of the tendon is shorter than the outer; by forcing the foot out and the os calcis over, it is stretched fibre by fibre, as when we tear a bandage from the tense edge, and when the valgus position is established, the resistance is diminished."

After over-correction of the varus element the tendo Achillis may be divided and the foot flexed; but in most cases it may preferably be stretched by turning the set screw at the ankle-joint of the apparatus soon to be mentioned.

Up to this point all ordinary cases can be successfully treated by means of a simple home-made splint, if only the principles above outlined are carefully followed, but so soon as the deformity has been sufficiently reduced to permit the patient to place his sole squarely on the ground he will need a retentive apparatus, which will hold his foot until the tissues are stable in the corrected position and there is no tendency to the return of the deformity.

As a matter of convenience, I am in the habit of applying leverage in these cases, both to reduce the deformity and to hold the foot in the corrected position, by means of a steel apparatus, the usual form of which I now show, and which has previously been sufficiently described[1] This apparatus is at first adjusted to the deformed position of the foot by bending the steel shank near the ankle. It is worn day and night, is frequently readjusted, and

[1] Vide Transactions, vol. ii, pp. 252 and 253.

when necessary the leverage is increased by straightening at the shank, so that a moderate corrective force is continuously exerted against the abnormal curves. All strapping is carefully guarded from harmful constriction, while precision of action is much increased by the use of a three-tailed adhesive plaster applied to the leg, and ending in a strip of webbing which is buckled to the side plate of the apparatus near the heel, and which gives perfect control of the foot by keeping the heel in contact with the sole plate of the apparatus. It will be seen from the foregoing analysis of the abnormal curves in this affection, and an inspection of the apparatus and model shown, that each abnormal curve is continuously acted upon by a corrective leverage controllable by the operator. The proximal curve formed by the os calcis with the tibia is counteracted by the lever formed by the leg-bar and heel end of the side plate, and completed by the strap above the ankle. The distal curve, formed by the os calcis with the metatarsus at the inner side of the foot, is counteracted by the ends of the side plate, whose leverage is completed by the band passing over the cuboid and top of the arch of the foot; while the plantar curve is corrected by the same band acting with the sole plate of the apparatus. When the deformity has been so far overcome as to enable the patient to place the sole squarely on the ground, walking with the splint properly applied will help the patient, since the weight of the body under these circumstances will assist the corrective leverage. It is just at this point that so many failures have occurred in the treatment of congenital equino-varus. The original deformity has been wholly or partially corrected by mechanical means or operative procedures, and the patient is soon permitted to walk about. But as the muscles and ligaments on the long or convex side of the limb have not yet had time to shorten and grow firm they are not able to oppose so much resistance to the forces wh ch act upon the foot in walking and other movements as the tissues on the inner or concave side. In addition to this, the bones of the foot are imperfectly adapted to their new position, since their relations were developed in quite a different one, namely the equino-varus position. So, there being no adequate force to oppose it, the foot gradually slips back toward the original faulty position. Repeated operations on the concave side, and the adaptation of apparatus which imper-

fectly grasps the foot and allows it to slip and turn will not meet the difficulty. The deficient forces must be supplied by the exact prehension of the foot, and the continuous application of leverage in such a manner that the foot shall always be held in a slightly over-corrected position, until the previously overstretched and elongated tissues are solidified. It will thus be seen that it is quite as important to have complete command of the corrected foot as it is to effect the reduction of the deformity, and any operation or process which only aims to reduce the deformity must be regarded as but an incident in the treatment. In most cases under six or eight years of age, and in many older subjects, the deformity can be reduced within a few weeks[1] by the method of continuous leverage, which, besides rendering operative procedures unnecessary, presents the additional advantage of moulding the tissues of the foot into normal relations by a proper distribution of pressure. The foot is then to be held in its corrected position from one to several years; while the patient is seen only occasionally by the physician, has full liberty, and walks about independently in his brace, which is concealed by his shoe and stocking.

The form of the apparatus must be modified to meet special indications in particular cases. Inversion at the knee may be controlled by an apparatus reaching to the hip, and, if necessary, the addition of a hip-band will regulate hip rotation.

In secondary cases following polio-myelitis the same principle of treatment is employed, with proper provision for protecting weak muscles by limiting motion at the ankle-joint. Such cases can often be successfully treated, even after full growth is attained, and tenotomy is seldom necessary. In the deformities following the cerebral palsies and associated with a spastic condition of the muscles, tenotomy is positively indicated in addition to mechanical

[1] *October, 1892.*—Within a fortnight I began the treatment by continuous leverage of the right foot of a boy of two years, born with equino-varus, which had resisted doctors and braces, including a "Taylor" brace; the boy continued to walk on the outer side of the foot. In one week's time, with four office visits, and without violence or discomfort, the foot was in the valgus position and the child walking on his sole, to his mother's infinite astonishment. Such results can be accomplished with certainty, though not always as rapidly, when correct principles of treatment are carried out with painstaking precision of detail.

treatment, since the spasm is seldom or never permanently overcome by stretching.

The treatment of the valgus deformity, which is usually more difficult than that of the varus, is analogous in principle. Leverage is applied to the outer side of the foot and leg by means of an apparatus similar to that employed in varus, but reversed in its action.

The simple equinus deformity may often be reduced by stretching, but very severe cases are more appropriate for tenotomy of the heel-cord than other deformities, since the relations of the small bones of the foot are not seriously disturbed. The mechanical after-treatment must be attended to to prevent relapse or over-correction.

In calcaneus, ankle-flexion is prevented by a stop at the ankle-joint of the apparatus, while the weight of the body in standing and walking is transmitted from the anterior end of the sole-plate through the apparatus to a broad band passing in front of the head of the tibia.

In concluding I would draw special attention to the fact that the cases of congenital deformity which have been discussed are readily curable in early childhood by mechanical means alone, while the foot deformities due to polio-myelitis, the commonest cause of secondary club-foot, are preventable by correct mechanical treatment, applied early in the affection, so that recourse to operative procedures at a later stage is evidence of neglect of simpler and more perfect means at an earlier period.

OPERATIVE TREATMENT OF RESISTANT CLUB-FOOT.

By E. H. BRADFORD, M.D.,
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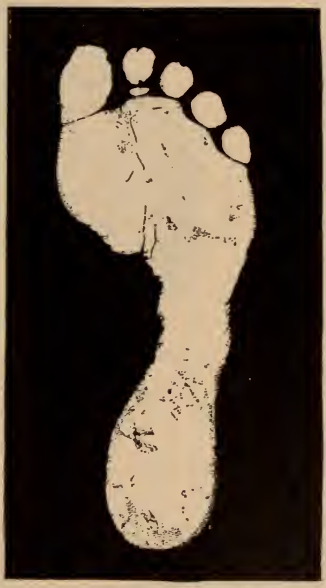
In presenting this paper, written on the subject of the treatment of resistant club-foot by means of radical operation, the statement should be made at the outset that it is not intended to advocate

Fig. 1.

Imprint of foot of a child sixteen years old, treated when one year old for congenital club-foot.

Fig. 2.

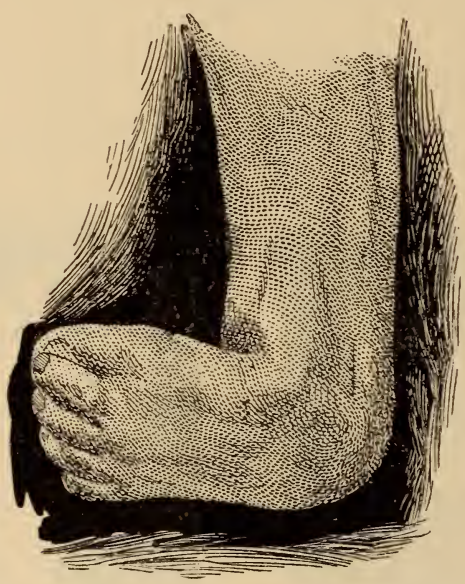


Imprint of normal foot.

operative interference, even tenotomy, in all cases of club-foot, even of the congenital form. One of the most successful cases

of congenital club-foot I am able to report was treated without any operative measures, even tenotomy. The result may be shown by the accompanying foot-print (Fig. 1). The drawings from photographs have already been shown;[1] but the foot-imprint is even more convincing than the photograph, and warrants the assertion that the feet are now perfectly normal in a child fifteen years of age treated without tenotomy when a year old. This can be seen by a comparison with the imprint of a normal foot (Fig. 2).

Fig. 3.



Drawn from photograph of a woman thirty-five years old, suffering from congenital club-foot.

In this article, investigation will be limited to those cases which, either through previous neglect or bad treatment, or the obstinate nature of the deformity, have developed into the most persistent type of the distortion, resisting the simpler measures of treatment. In the 160 cases I have treated there has been no hesitation to perform more radical operations, such as wedge-shaped exsection of the tarsus; though this method, as will be seen later, is at present not

[1] Transactions American Orthopedic Association, vol. i.

advocated. While it is readily admitted that the successes of Drs. Taylor, Judson, and Shaffer have shown conclusively that club-foot can be in many instances satisfactorily corrected by means of mechanical treatment alone, in advocating operative measures for the persistent cases the claim is made that in the severest and most resistant cases cure can be effected more speedily, certainly, and

Fig. 4.

The foot one year after forcible correction.

safely by proper radical operative measures than by simpler means. As Dr. Morton has well said, some cases of congenital club-foot are corrected without great difficulty and permanently cured, while in others the deformity is resistant, and there is a tendency to relapse; and in treating of club-foot, in some instances time is of importance, and also the inefficiency or poverty of the parents has to be considered. Many resistant cases could be treated by mechan-

ical means alone, provided the parents had sufficient persistency to continue the treatment for six months or a year or longer with daily or frequent visits; but where persistency and attention cannot be commanded, mechanical treatment becomes impossible, and these cases remain doomed to deformity unless some means can be devised which will enable the surgeon to cure in a short time. It is for this reason that operations on the bone, radical in character, are sometimes demanded which otherwise might have been avoided. The choice is between such methods as involve the least mutilation and give the best results in the speediest time.

Of these methods three deserve careful consideration: (1) Forcible correction, preceded by thorough division of the ligaments and tendons; (2) removal of the astragalus, an operation frequently performed on the European continent, and advocated lately by Dr. Morton, of Philadelphia;[1] (3) osteotomy of the neck of the os calcis and of the astragalus, preceded by careful division of the soft parts of the inner side of the foot.

It is not proposed to consider the claims of wedge-shaped resection of the tarsus, although this method has given good results. But anyone who has had experience with it will know that an unnecessary amount of bone is sacrificed where this method is relied upon.

Forcible correction, combined with division of the shortened soft tissues accessible to the knife, will be found to be a method which in a large majority, even of the most resistant cases, will prove entirely satisfactory. It has the advantage of avoiding any unnecessary sacrifice of bony tissue, and has given excellent results.

The accompanying illustrations will serve to show the fact that in cases of the severest type the method is capable of giving satisfactory results without any sacrifice of bony tissue (Figs. 3, 4, 5, 6).

This case has already been reported in the *Revue d'Orthopédie*, March 1, 1892.

The foot-imprint represents the ultimate result three years after operation, and shows a sole of a foot entirely flat in walking, which three years before had been of the severest type of deformity, in a woman thirty-five years of age. A lever wrench was used in cor-

[1] Transactions of American Surgical Association, 1890, vol. viii. p. 71.

rection previous to tenotomy having been done. Two sittings were required, as the skin tore on the inner side of the foot at the first, and it was thought advisable to delay complete rectification until a fortnight had passed after the first sitting. The patient was enabled to walk about with crutches two weeks after the second operation, and a splint was applied one month later. The patient began to walk with the splint and a cane about this time, and she is now

Fig. 5.

Foot one year after forcible correction.

able to walk about freely without any appliance. It is now four years after the operation.

She suffered somewhat a year after the operation from the pain of flat-foot, the foot having been over-corrected, and the woman being stout and heavy. The cure may be considered complete and permanent.

In regard to a choice between open incision and subcutaneous division of the soft parts preceding forcible correction, in a majority of cases I have employed the subcutaneous method, using a section

of the insertion of the anterior and posterior tibialis anticus tendon and of the scapho-astragaleal ligaments, according to the method recommended by Drs. Parker and Shattock. After some practice with these methods, it has hitherto seemed to me that I have been able in a majority of cases to satisfactorily divide all of the soft tissues by subcutaneous division. The plantar fascia is divided first; the tenotome is then inserted on the inner edge of the foot, at a short distance below the internal malleolus, directly toward the

Fig. 6.

Sole-imprint of the same foot three years after forcible correction.

scaphoid; it is then passed directly under the sole of the foot, hugging the bone, and drawn inward and forward, keeping close to the edge of the scaphoid as it joins the astragalus. The tenotome is then inserted on the outer side of the foot at the junction between the cuboid and the os calcis. After this the foot is forcibly corrected, such fibres as have not been thoroughly divided being stretched, and the tendo Achillis is divided with the tenotome.

But in many cases during the past year I have operated by means of an open incision, introduced by Dr. Phelps; and I must frankly

admit that the readiness with which everything is exposed, and the certainty with which everything can be divided, has led me to

Fig. 7.

Congenital club-foot in a boy six years of age, drawn from a photograph.

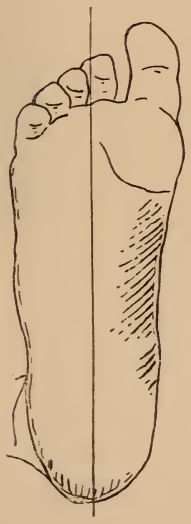
Fig. 8.

After forcible correction.

Fig. 9.

Plaster-of-Paris imprint from a boy of eleven, after excision of astragalus for resistant club-foot.

Fig. 10.



Drawn from photograph of foot of a boy of eleven, after osteotomy of neck of astragalus for club-foot.

believe that, contrary to my previous opinion, the latter method is more thorough, and is to be preferred in resistant cases. There is one slight disadvantage, namely, the greater time needed for healing, as compared with that after subcutaneous division. The resulting scar is also an objection, though not a great one. In one case I have seen over-correction in a flat-foot follow too extensive section, but this can be avoided by proper judgment.

Fig. 11.

Sole-imprint after removal of astragalus for club-foot.

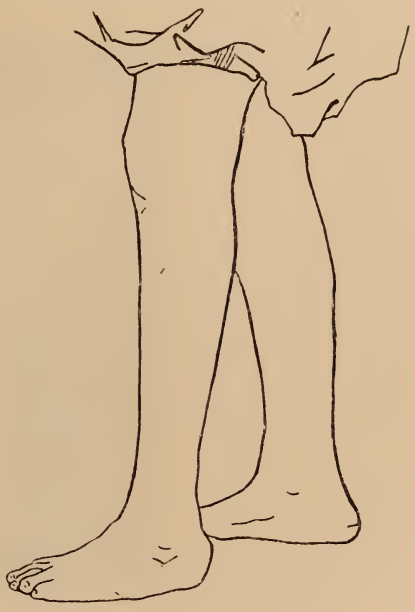
The case of forcible correction mentioned well represents what can be done in a great many club-feet of the severely resistant type by this method; but in some instances such perfection cannot be attained in this way; either the deformity is so great, or the undivided interosseous ligaments resist, that it is impossible to thoroughly over-correct. Repeated operation will in time stretch the contracted ligaments, but in some instances a satisfactory result is not gained. Example of this will be seen in the accompanying photographs (Figs. 7, 8). The deformity was of a very severe type; one foot was entirely over-corrected; the left foot, however,

was nearly corrected, but not enough to prevent a relapse.[1] In this instance a great deal of force was used, and two sittings were given; but what appeared to be resistance at the joint between the cuboid and the os calcis was sufficiently strong to prevent bringing of the cuboid into an over-corrected position. The distortion at the astragalo-scaphoid articulation was satisfactorily corrected, but when the attempt was made to raise the outer edge of the foot at

Fig. 12.

Drawn from photograph after removal of astragalus of left foot for club-foot.

Fig. 13.



Drawn from photograph after removal of astragalus of left foot.

the same time that the front of the foot was turned up and brought up, an amount of resistance was encountered which could not be corrected by force. It formerly appeared to me that this was due to the strength of ligamentous bands uniting the important tarsal bones, and that if sufficient force were applied the difficulty could be overcome.

[1] The patient died of diphtheria before an operation for complete correction of the left foot could be undertaken.

I am unable to state in how large a percentage of cases complete correction by means of force is possible. In a large number of cases this is true, but experience has shown me, in the one hundred and sixty cases which have come under my care, that in five, relapses have occurred after satisfactory over-correction by force, as in the case just mentioned. In most of the cases the feet were small, the children being very young. I had explained this on

FIG. 14.

Drawn from photograph after removal of astragalus.

the supposition that owing to the elasticity of the bones in the feet of children, the force could not be applied in such a way as to rupture or stretch the contracted ligaments. It also seemed probable that in some instances deformity of bone was the impediment; and for this reason I have in the last year excised the astragalus in five cases, in the belief that the astragalus was the bone chiefly affected, and because excellent results were reported as following this operation, especially in the interesting article by Dr. Morton. The results in five cases operated upon by me in this way are

given below. The operation is itself a simple one. An Esmarch bandage is applied, and an incision made on the outer side of the foot, beginning a little above the external malleolus, and curving forward and reaching to slightly beyond the head of the metatarsal. After dissecting back the flaps by cross incisions, the astragalus is separated from the scaphoid, the tibia and fibula, and, after forcibly twisting the foot, from the os calcis. Some difficulty is often encountered in dividing the strong ligament between the astragalus

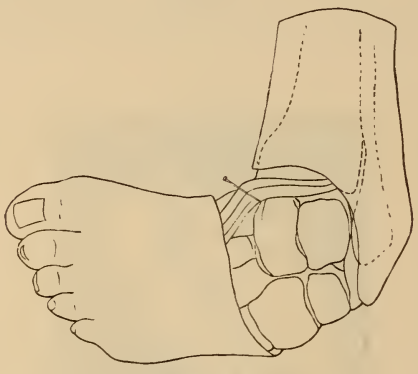
Fig. 15.

Sole-imprint of a case of club-foot corrected by tenotomy with inversion of the foot without contraction.

and os calcis, but after the use of some care this ligament is divided, and the astragalus is removed. A counter-opening is sometimes made on the inner side of the foot; the wound through the skin is stitched; and after removal of the Esmarch bandage, the wound is dressed aseptically and the foot placed in a corrected position, and fixed by means of a plaster bandage applied over a large aseptic dressing. The foot can, after operation, be placed without difficulty in the proper position, and if proper care is used in asepsis, no evil effects follow the operation, and the wound

should heal well. After three weeks the plaster bandage is removed, an appliance put on, and later the patient allowed to walk. The result is a useful and often an excellent foot, correcting appliances are not required after the ankle regains strength, that is, in from two to three months.

Fig. 16.



Drawn from specimen of adult club-foot.

The results after this operation are shown in the accompanying pictures. It will not be found, however, that the results are entirely perfect, and it must be admitted that the removal of so large and important a bone as the astragalus is in itself a mutilation which it is desirable to avoid if as good result can be obtained in other ways. An examination of the imprints of the sole in all the cases showed that a slight inversion still remains. This gives a result which, although satisfactory in that the resulting feet are not noticeably deformed and are useful, cannot be regarded as perfect, and perfection is what should be aimed at. This may be seen in the tracing of the feet shown in the accompanying illustrations. If the sole of a normal foot be examined, it will be noticed that a line drawn through the middle of the sole is a straight one. In the cases of club-foot after removal of the astragalus, it will often be seen that the median line in front of the medio-tarsal articulation forms an angle with the median line posterior to that articulation. This, which is not to be seen in a normal foot, is evidently due to the obliquity of the anterior facet of the os calcis, normally at right angles to the long axis of the foot, as it is well known from

pathological specimens that this obliquity exists in a certain number of cases. A picture of the sole of what may be termed a perfect result is seen in the accompanying photograph (Fig. 10).

In two of the five cases of excision of the astragalus I have done, the deformity was in both feet; in the others the deformity was of one. In all the cases the deformity was congenital, and had been treated with care before. Two of the cases had been

Fig. 17.

Imprint left foot, congenital club-foot, before operation.

Fig. 18.

Imprint right foot before operation.

treated by me, and had relapsed later; and they were earlier cases where the details of treatment were not as thoroughly understood by myself as later experience has taught. One was a boy of twelve; the second was a boy of ten, double deformity; the third, a boy of six; the fourth, a boy of ten; and the fifth, a girl of ten. The results were satisfactory.

In all of these cases the slight obliquity inward of the anterior portion of the feet was noticed, marring the perfection of the result, though in no way preventing the usefulness of the foot or

the activity of the child. This is indicated by the sole-impression of the imprint of the foot of Case II. (Fig. 11). In Case V., some twisting of the foot remains, as is seen by the illustrations (Figs. 12, 13). The astragalus was removed without difficulty. The wound healed; and the patient was soon able to walk about freely, with motion at her new ankle-joint. Judging from external appearances and the history of the case, it is evident that some internal

Fig. 19.

Imprint left foot after operation.

Fig. 20.

Imprint right foot after operation—osteotomy of neck of astragalus and os calcis.

and anterior obliquity at the articulation of the os calcis must be present, for after removal of the astragalus the inward inversion of the front of the foot should disappear, unless some other cause than the distortion of the astragalus was present (Fig. 14.)

If the removal of the astragalus is not sufficient for complete correction, it is evident that the deformity exists also elsewhere, and the obliquity in the facet of the head of the os calcis suggests itself as a cause of the continuance of the distortion. This obliquity

of the os calcis is demonstrated by the accompanying footprint, which shows the footprint of a case of congenital club-foot, treated

FIG. 21.

Drawn from photograph before operation in boy of twelve.

FIG. 22.

From photograph after operation in boy of twelve—osteotomy of neck of astragalus and os calcis.

by mechanical stretching and tenotomy of the tendo Achillis (Fig. 15). The deformity is entirely corrected, as far as can be demon-

strated by complete flexibility and excellence in gait. There are at present no contractions either in the tendo Achillis, plantar fascia, or in any part of the foot. The foot can be placed readily in an over-corrected position. The child walks about without apparatus, which has been discarded for several years. There is a tendency, however, for the child to toe in, especially when running, and the footprint indicates that the anterior part of the foot turns to the inside. This appears to be due to the obliquity in the articulation of the facet of the os calcis. The same condition is

Fig. 23.

Drawn from photograph after operation.

seen in the photograph from the dissection in the Warren Museum (Fig. 16), and even better in a specimen of adult congenital club-foot prepared by Dr. Goldthwait.

On examination of this specimen, it will be clearly seen that the obstacles to the correction of this deformity do not lie alone in the distortion of the astragalus, nor in the ligamentous tissues which bind the scaphoid to the astragalus. After these may be removed, there remain evidences of distortion in the os calcis at its junction with the cuboid. The articulated surface of the os calcis, as it lies in contact with the cuboid, is oblique relative to the axis of the foot, rather than at right angles to this axis. It is manifest that

in this individual case it would be impossible to entirely replace the cuboid in the proper position in relation to the os calcis simply by a division of the soft parts on the inner side of the foot, and also that after removal of the astragalus all the osseous obstacle to correction is not removed.

Fig. 24.

Drawn from casts before operation in a boy of ten with congenital club-foot.

The method of procedure for attacking the projection of the os calcis is a simple one. An incision should be made, starting below the external malleolus with convevity upward reaching to the projecting head of the astragalus, and passing downward toward the outer side of the foot toward the sole. This flap should be drawn down by means of hooks, and the neck of the os calcis laid bare. An osteotome can be inserted a short distance from the line of the cartilage, and the wedge-shaped piece of bone removed from the neck. The foot can be forcibly corrected with but little force if the contractions of the soft parts on the inside of the foot have been stretched or divided. If, however, there is, as often occurs, also resistance at the astragalus, the upper portion of the skin above the incision can be retracted, and the neck of the astragalus

easily seen, an osteotome inserted, and either the astragalus divided by a linear osteotomy or a wedge-shape piece removed. The operation can be done very readily and with but little mutilation of the foot.

I have operated in this way in three cases of double congenital club-foot with satisfactory results in the past year. The accompanying photographs and imprints indicate the results. They were taken (Figs. 17, 18, 19, 20, 21, 22, 23, 24, 25) some time after the operation, proving the ultimate result to be satisfactory. Nothing

FIG. 25.

Drawn from photograph after operation—double osteotomy of neck of astragalus and os calcis.

of particular interest in the history of either case is to be recorded, except that in the first case open incision was done on one foot, and osteotomy of the neck of the os calcis and the astragalus were done upon the other foot with tenotomy, but without open incision on the inner side of the foot. The result, as indicated by the tracing, would appear to show that the open incision without osteotomy gave a more satisfactory result than osteotomy following subcutaneous tenotomy. This is, perhaps, due to the fact that the foot on which

osteotomy was done was the more severely deformed of the two. But it may suggest also the fact, which I have found in other instances, that subcutaneous incision does not divide as thoroughly as an open incision. In several instances I have divided by means of subcutaneous tenotomy as thoroughly as I was able to do, and I have subsequently cut down by an open incision to see if I had left any tissues undivided; and I have satisfied myself that, with the tenotome in the foot, fibres may be left undivided by subcu-

Fig. 26.

Sole-imprint after osteotomy of neck of os calcis and astragalus.

taneous division which can be only discovered by open incision, as is the case in subcutaneous division of the insertion of the sterno-cleido mastoid.

In the second case (Figs. 24, 25) the result was entirely satisfactory, and both were operated upon by osteotomy of the neck of the astragalus and of the os calcis. In previous cases I have attempted to osteotomize the neck of the os calcis without thorough division of the plantar fascia in inner ligaments. They were earlier cases, and the operation was not done with precision or with the carrying out of the details already mentioned; and they may

be fairly considered experimental cases. Although the deformity was corrected satisfactorily and useful feet resulted, yet the greatest possible perfection was not gained, as is shown in the accompanying footprint (Fig. 26), which, it will be seen, though that of a useful foot, and in result to be compared with that after enucleation of the astragalus, yet is not so excellent as in the best cases.

In conclusion, it can be said that not only is club-foot of the most persistent variety entirely and completely curable, but also that in many cases the milder means are sufficient. It is, however, demonstrable that in a certain number of cases osseous deformity of the neck of the astragalus and os calcis exists; and where this exists, the perfect correction can be made with but little mutilation of the bone, by either a linear osteotomy of the neck of the os calcis and of the astragalus, or the removal from the neck of either or both a small wedge of bone, if this is preceded by thorough division or stretching of the contracted soft parts. Thorough lengthening of the contracted ligaments and fasciæ, as well as tendons, either by stretching or tenotomy or open incision, is essential for a perfect result; if this is not done a less perfect result is obtained.

MEANS FOR THE PREVENTION OF RELAPSE AFTER THE CORRECTION OF DEFORMITY IN CLUB-FOOT.

By B. E. McKENZIE, M.D.,
TORONTO.

The partial recurrence of the deformity after all modes of treatment having for their object the rectification of the malposition of club-foot is seen so frequently that an inquiry as to the causes and the means by which relapse may be prevented is one of much importance.

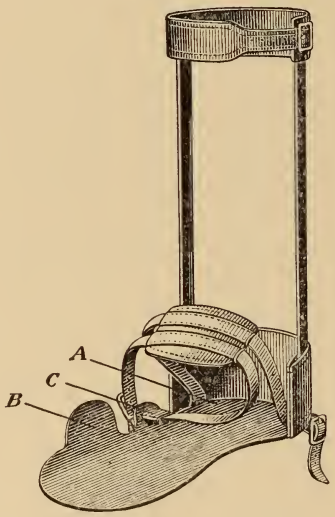
No one tissue of the foot is entirely at fault in causing or maintaining the deformity. Before treatment, skin, fasciæ, ligaments, tendons, and bones at the inner side of the foot are too short, and the tissues at the outer side are relatively lengthened. When correction is being made by non-cutting methods, the tissues at the outside become shorter only by the same processes of change as occur in the tissues behind the knee when the leg has been long flexed—namely, by contracture. The same is true in methods of operation dependent upon cutting the shortened structures of the concave part of the foot. A long time is essential in order to permit of sufficient shortening to hold the part of the foot anterior to the mid-tarsal joint well everted.

The shortened tissues of the inner side, when stretched so as to permit even of over-correction, long manifest their elasticity and a disposition to invert the foot, relapse not infrequently resulting.

The patient is sometimes permitted to spend the night in bed without having any retentive apparatus to hold the recently corrected foot in proper position, and in the daytime either wears an ordinary shoe that has little power to keep the foot right, or some form of apparatus that greatly restricts the natural movements and

development of the foot. Not only has the natural tendency to relapse full play, but the weight of the bed-clothes serves to drag the feet into the old position. This may be prevented by a very simple night appliance, shown in Fig. 1, in which the foot may be kept fully corrected without causing discomfort. In the use of this brace it is seen that the posterior part of the os calcis and the head of the first metatarsal bone rest against supports *A* and *B*, while a strap passing over the foot pulls the mid-tarsal region downward and inward toward the fixed point *C* on the brace. At the

Fig. 1.

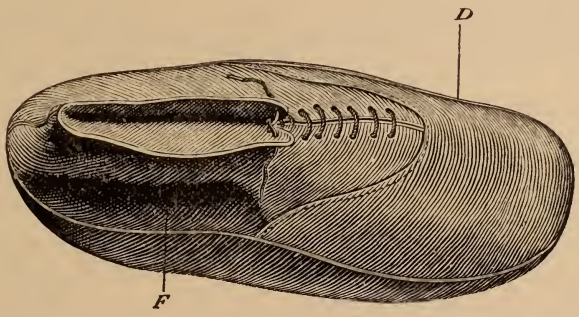


same time the heel is held down by a strap passing over the instep and under the hinder part of the sole-plate in the ordinary way.

In the daytime a shoe may be worn which is simple in its construction, and yet compels the wearer to so place the foot on the ground as to avoid the in-turning of its anterior part, and also its rolling outward. In the construction of the shoe there are two points demanding attention: 1. The last upon which the shoe is made is not the ordinary straight last. Its anterior half is deflected outward, so that when the shoe is made the part which covers the anterior half of the foot is everted. At the same time the upper of the shoe is supported on the inside, at the part covering the head

of the first metatarsal bone, by a strong counter, and on the outer side at the part corresponding to the cuboid bone and the base of the fifth metatarsal. 2. The foundation of the shoe is so thickened

Fig. 2.



toward its outer part and projected outward beyond the upper as to raise the outer border of the foot and tend to roll it over toward the inner side.

Fig. 2 shows a shoe constructed in accordance with the principles enunciated. The heavier shading at *D* and *F* shows the position of the resisting counters in the shoe.

THE WEIGHT OF THE BODY IN ITS RELATION TO THE PATHOLOGY AND TREATMENT OF CLUB-FOOT.

By A. B. JUDSON, M.D.,
NEW YORK.

I DESIRE to present a few thoughts, of an extremely practical kind, relating to the treatment of talipes equino-varus. Beginning with congenital club-foot, it is well to bear in mind that there is a vast difference between a child recumbent and a child walking. While the child is in arms the case is yet free from the complications and difficulties caused by the falling of the weight of the body on the deformed foot. These twelve months, more or less, are the most important year in the history of the case, because, in this period, the foot is to be so changed that, when the child begins to walk, the use of a slight walking-brace, exerting only a moderate degree of force, will convert the weight of the body from a deforming to a correcting agent. During these months of recumbency, with the weight of the body out of the way, with all the tissues soft and formative, and the foot more than doubling in size with the growth of the child, there is every reason to expect to succeed in what we undertake, provided time enough be given to the case, and faithful attention to the details.

The apparatus which I have conveniently used to affect this reduction, before the child learns to stand, is a simple retentive splint which acts as a lever, making pressure on the outer side of the foot and ankle, at A, in Figs. 1 to 4, inclusive, and counter-pressure at two points, one on the inner side of the eg at B, and the other at the inner part of the foot, at C. It is advisable to keep in mind that this simple instrument is a lever, because, if we know we are using a lever, with its three well-defined points of pressure, we can

make the apparatus more efficient than if we view it, in a more general way, as an apparatus for giving a better shape to the foot.

I use a little brace made of sheet brass, doing the work with a few simple tools. An advantage of doing the work one's self is that there is no room for doubt as to where the blame lies, if the apparatus is not effective. Two covered disks, B and C, Figs. 3 and 4, are riveted to a shank, D, and thus is formed that part of the brace which applies the two points of counter-pressure, while, on the other hand, the point of pressure is brought into action by a third disk, or shield, A, which is drawn tightly against the outer side of the foot and ankle, and held in place by a strip of adhesive plaster, E, which includes the limb and the piece, D, which connects the two disks, B and C. The disks are lined with two or three thicknesses of blanket, easily renewed, when necessary, with a

Fig. 1.

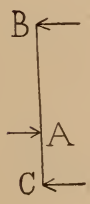


Fig. 2.

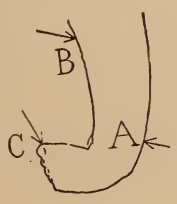
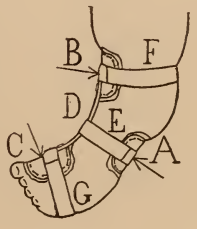


Fig. 3.

Fig. 4.

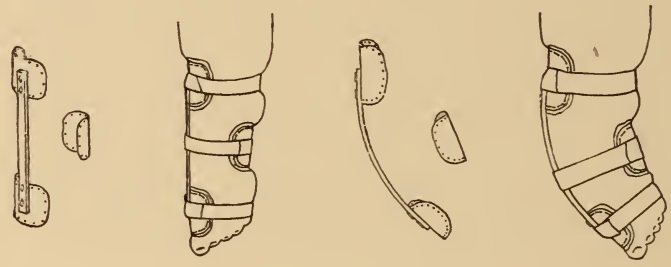


needle and thread. These braces are so cheap and easily knocked together that it is nothing to apply new and larger ones, using heavier material for the shank as the child grows. In general, three sizes will be enough, the shanks being 12 gauge, $\frac{3}{8}$ in. wide; 14 gauge, $\frac{1}{2}$ in. wide; and 16 gauge, $\frac{5}{8}$ in. wide. The disks are conveniently made from 22 gauge, $1\frac{1}{4}$ in wide. The rivets are copper belt rivets No. 13. A lip turned on the edges of the disks, with the flat pliers, gives stiffness to the thin brass and protects the skin from the rough edge. If more easily obtained, tin disks, light bars of iron or steel, and ordinary iron rivets, would doubtless answer.

The brace is applied with three strips of adhesive plaster. The upper and lower pieces, F and G, Fig. 4, are simply to keep the apparatus in place, which they do effectively if ordinary gum plaster is used, while, by drawing the middle strip, E, tightly over

the shield, and straightening the brace from time to time, the deformity is gradually and gently reduced. At each reapplication the brace is made a little straighter than the foot at that stage. This may readily be done by the hands, and then the adhesive strip is to be tightened over the shield till the shape of the foot agrees with that of the brace. After a few days the brace is to be made still straighter, and again reapplied, and made tight until another point of improvement is gained. The brace is applied very crooked at the beginning of the treatment, as in Figs. 3 and 4, and is straightened from time to time, and a longer brace applied as the deformity is reduced and the patient grows. It should be removed every week, or two weeks, and an interval of a few days allowed for freedom from the brace, when the mother is advised to

Fig. 5. Fig. 6. Fig. 7. Fig. 8.



manipulate the foot constantly, using as much force as she will in the direction of symmetry. Manipulating the foot during these intervals is of great importance, as cases have occurred in which varus and equinus have been entirely overcome by the mother's hand alone.

By this simple and prosy treatment, carried out systematically and without haste or violence or pain, the foot, unless it is a frightful exception, may, with certainty, be changed from varus to valgus. At the same time the tendo Achillis is lengthened till the position of the foot is near the norm, or at right angles with the leg, as the result of manipulation, and giving the brace from time to time a partly antero-posterior action. Figs. 3 and 4 show approximately the shape of the brace at the beginning of treatment, Figs. 5 and 6 when the varus is reduced, and Figs. 7 and 8 when valgus has taken the place of varus. The foot in this latter stage

may not hold itself valgus when left to itself, but, with almost no force and with one finger, it may be pushed into valgus; and in this condition it must be when the child begins to walk, and then another stage of treatment begins.

When the patient begins to walk we have a new difficulty. It is now seen that the weight of the body, falling on the tender and ill-formed foot, will, if not properly directed, defeat all our efforts. Let us, for a moment, consider the mechanical environment of the human foot. In the first place, the corporal weight, which the quadruped distributes among four pedal extremities, falls in man upon two. Again, the small floor area covered by the feet, and their slight structure, seem unequal to the task of supporting the towering frame above them, which in some cases almost resembles a pyramid resting on its apex. And when we observe the effect of active locomotion we see weight and momentum combine in an an apparent effort to crush and destroy. And furthermore, when additional weight is borne and the strain is prolonged, as in the case of the burden-bearer among savage tribes, or the infantry soldier on a forced march, the endurance of the foot excites wonder. It is not strange that the feet are subject to ailments: to blisters, bunions, ingrowing nails, hallux valgus, hammer-toes, loss of the arch, weak ankles, painful affections of the metatarsus, perforating ulcers, osteitis, and the varieties of talipes. The wonder is that they are not permanently disabled soon after walking is begun, and certainly when the adipose tissue of the body takes on the development which accompanies age and good living. The gourmand, Savarin, said that, among the works of creation, the design of the human foot was a conspicuous failure. Considering the immense weight carried by the foot, it is evident, however, that only the most perfect natural adaptation of mechanics has enabled this insignificant member to perform its superlative functions, and that great caution should attend all procedures having for their object its artificial reconstruction.

It is also sufficiently evident that the correction of club-foot by mechanical means, while the patient continues walking, is a problem beset with difficulty. We have, however, a luminous ray of hope and encouragement in the observation that, in talipes varus, there is an important boundary line between deformity and the norm. If

the foot is held in some way, now to be considered, on the right side of this boundary line, each step forces it in the direction of valgus, and the increasing weight of the child is a powerful force acting in the right direction, or away from varus, so long as the foot is held, though never so little, looking toward symmetry. It may be said that a child stamps his foot straight. If, on the other hand, the foot is held, or allowed to fall, on the wrong side of this line, though never so little, each footstep is a blow, driving the foot more and more into the varous position.

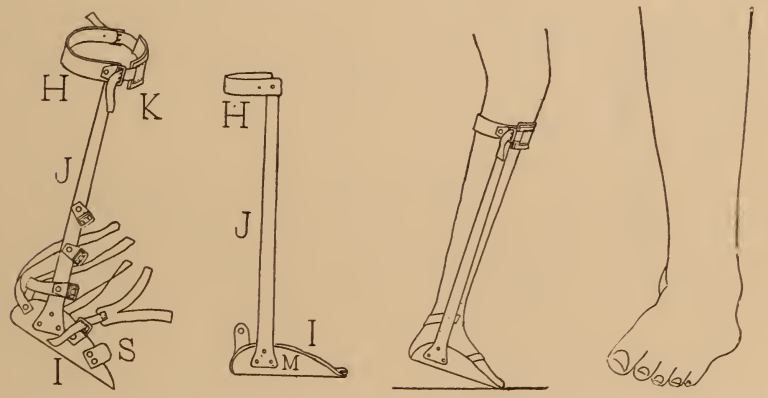
This point may be illustrated by the hand placed with its ulnar border on the table. If considerable pressure be made on the table by the hand so placed, it becomes evident that there is a boundary line between pronation and supination. If the hand is pronated never so little, additional pressure will force the palm into pronation, which represents valgus in the foot, and if the hand be supinated in the slightest degree, additional pressure will force the palm into complete supination, which represents varus in the foot.

By the application of this idea the weight of the body may be made a beneficent, instead of a harmful, factor in the progress of a case of talipes varus, and the walking brace should be constructed with this in view. It should be made of steel and by an instrument-maker. One of its functions is to act as a lever, but the leverage is applied not chiefly to overcome the deformity by direct force, as in the retentive brace above described, but to hold the foot on the right side of the boundary line above mentioned, so that the weight of the body may straighten the foot, or overcome the varus in a direct and forcible manner, without general or local inconvenience.

The walking brace consists, as usual, of leg-band, H (Figs. 9 and 10), foot-piece, I, and upright, J, riveted firmly together. A movable joint at the ankle should be discarded, as it undermines the lever by introducing an element of instability, and in this brace serves no good purpose. Mild steel alone should be used to facilitate alterations in shape, as point after point of improvement is gained, and to make easy the shifting of buckles and straps as may be required, all of which may be done by the use of a few simple tools. The upright is to be on the inner side of the leg, as in Fig. 14. The upper part of the brace makes counter-pressure

on the inner side of the leg, but it has another important function, in previously neglected cases, which is secured by the steel band passing across the back of the leg, to which are fastened two buckles for the attachment of a piece of webbing, K, in Fig. 9, which passes across the front of the leg. The steel band should make no pressure on the limb, as its use is simply to furnish attachment to the buckles. A piece of webbing spanning the front of the leg in this manner and carrying a pad performs an important service in cases, like the one shown in Fig. 12, in which, from previous neglect, the varus has not been reduced before walking begins. It transfers part of the body-weight from the anterior part

Fig. 9. Fig. 10. Fig. 11. Fig. 12.



of the sole of the foot, where it interferes with the correction of the varus, to the upper part of the anterior surface of the leg, where it is powerless to interfere with the treatment. That the weight-pressure thus transferred is considerable is shown by the callus and bursa which appear where the padded strap crosses the leg near the tubercle of the tibia. This mechanical effect is similar to that of the brace, shown in Fig. 11, used in the treatment of paralysis of the muscles of the calf, resulting in talipes calcaneus.

The upper part of the brace is also to be considered in another light, as follows: In previously neglected cases it is well to incline the upright 15°, or 20°, or more, backward from the vertical of the foot-piece, as is shown in Fig. 9. Although correction of the equinus is postponed by this inclination of the upright, we are thus

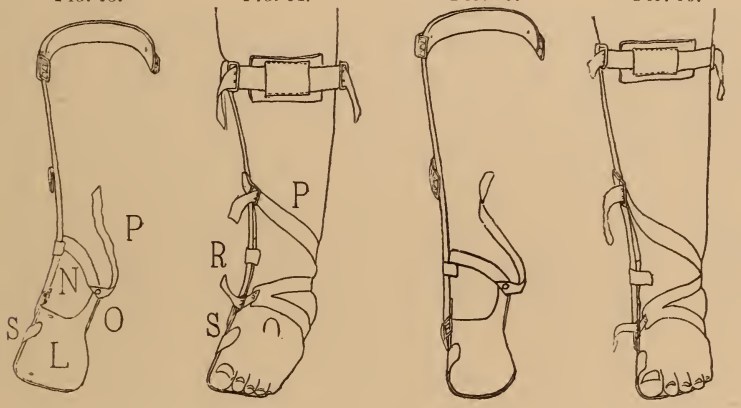
enabled to apply a better leverage against the varus, and when the varus is reduced, and the time arrives when the equinus is to be corrected, this backward inclination of the upright is to be lessened from time to time, till the vertical is reached, as in Fig. 10, or till the upright has an inclination forward, allowing the corporal weight to fall more and more on the anterior part of the sole of the foot, and gradually lengthen the tendo Achillis. The vertical upright, Fig. 10, is to be applied at once to patients in whom the deformity has been corrected before walking begins.

We will now pass to a consideration of the other end of the brace, the foot-piece, which is to be made of sheet steel ranging from 18 gauge, for a child learning to walk, to 13 gauge for an adult. It has the usual tread, L, Fig. 13, and riser, M, Fig. 10. The heel-cup is formed by a piece of webbing, N, Fig. 13, passing behind the heel, from the lower part of the upright to a spur, O, Fig. 13, which projects upward from the back part of the outer border of the tread.

Viewing the apparatus again as a lever, for the forcible reduction of varus, in a previously neglected case, counter-pressure is made along the inner border of the foot, and on the upper part of the inner side of the leg, while pressure is made by one strap, or more than one, riveted and buckled to the foot-piece and the upright. Only one strap is shown, P, in Figs. 13 and 14. This will be sufficient in the case of a child whose varus has been corrected before walking begins, but in a previously neglected patient in whom the varus has yet to be reduced while the child is active on his feet, two, three, or more straps may be added, as shown in Fig. 9, partly encircling the foot, ankle, and leg, the positions of the buckles and the straps being where they will assist most efficiently in opposing the varus and holding the foot in the best position to receive the weight of the body. These parts of the apparatus may be shifted many times, with advantage, in the treatment of a given case of unusual difficulty, and, in addition, a most efficient agent for applying continuous pressure is found in a strip of adhesive plaster, Q, Fig. 14, sewed to a piece of webbing, R, the plaster partly encircling the foot and ankle, with a single tail, or two tails, as may be required, and the webbing being drawn tightly and buckled to the inner side of the riser. This device does more than

simply increase the amount of pressure; it also keeps the heel down on the tread of the foot-piece, and, more important still, it gives the foot a rotation outward, and thus directs the sole of the foot forcibly toward the ground, in the best position for making the weight of the body a corrective instead of a deforming force. The riser of the foot-piece may also, in previously neglected and difficult cases, carry an ear, S, Figs. 9, 13, and 14, made of sheet brass, which is to be bent downward over the first metatarso-phalangeal joint, to prevent the inner border of the foot from over-riding the edge of the riser. The foot-piece is to be lined with adhesive plaster, in several thicknesses if necessary, to prevent rust, and with a piece of leather fastened to the tread and spur with copper rivets, as

Fig. 13. Fig. 14. Fig. 15. Fig. 16.

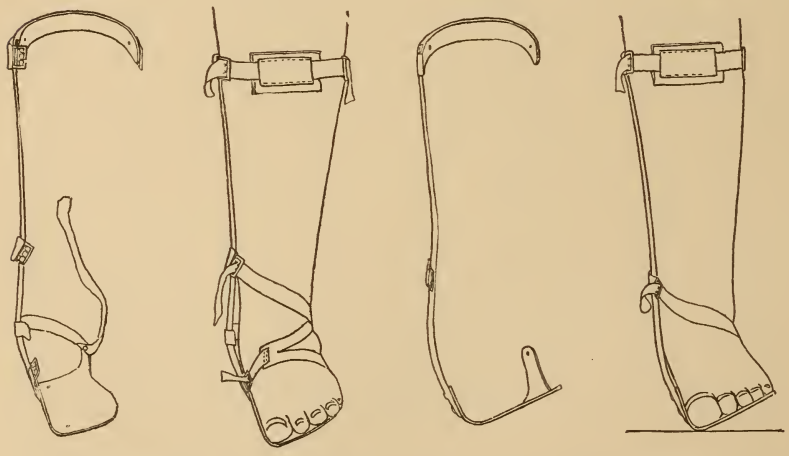


shown in Fig. 10. In practice the details demand as much attention as the principles of treatment. The brace is to be applied over the stocking, the strap, R, passing through a hole cut in the stocking, and is hidden by the patient's trousers and shoe.

We will now consider the upright of the brace. It is a flat, tapering bar of mild steel, and when first applied to a previously neglected case, such as is shown in Fig. 12, should have a curve resembling that of the varous foot. The bar, though sharply curved, as in Fig. 13, should, however, be somewhat straighter than the foot, when the latter is forced manually into its best position. The multiple straps, shown in Fig. 9, should then be buckled and tightened daily till the continuous leverage has partly reduced the varus. The upright bar should then be somewhat straightened

and another point of improvement be gained, the patient in the meantime following his ordinary pursuits without interruption. In due time the upright bar and the foot itself will both be straight, as seen in Figs. 15 and 16—in other words, the varus will be reduced. The upright should then be bent, from time to time, in the direction of valgus, as seen in Fig. 17, and the persistent and gradual effort resumed until the foot has been pushed, or pulled, or pried, over the boundary line, into the domain of valgus, as seen in Fig. 18. These efforts would not be necessary if the varus had been converted into valgus before the child had learned to stand. In very badly neglected cases the interference of the weight of the body with the treatment may be prevented by the recumbent position, or the use of a high sole on the well foot, and the ischiatic or axillary crutch, until the varus has been materially reduced. In all cases, when the child is old enough to be docile, domestic instruction and drill in eversion of the foot, and in the proper management of the foot in locomotion should be a part of the education.

Fig. 17. Fig. 18. Fig. 19. Fig. 20.



As soon as the foot has reached the valgous shape, whether it is at the moment of learning to walk, or only after prolonged effort, in a neglected case, a curious effect will be observed. It will be seen that the outer border of the tread of the foot-piece is raised from the ground, as seen in Figs. 19 and 20, and that we have secured, in a convenient manner, the effect which is sometimes

sought by building up the outer border of the sole of the patient's shoe. This is a welcome and powerful ally in our attempts to hold the foot in a favorable relation with the weight of the body and the ground.

The walking-brace has been above described as though its chief use were to reduce varus which has become more or less confirmed by the habit of walking on the outer border of the foot. Strictly speaking, such cases should never occur. They are, however, too common, and always indicate that the child has been neglected from the period of recumbent infancy, when deformity of this kind is the most easily overcome. If the varus were always corrected before the child learns to stand, then the only use of the walking-brace would be, as shown in Figs. 19 and 20, to gently hold the foot in valgus, so that the weight of the body shall be sufficient to lead the child to grow up with the foot practically normal. As such a child outgrows the brace, a larger one is to be made, and, when three or four years old, the foot will, without the help of the brace, strike the ground so fairly that, for two or three years, all treatment may be suspended. The patient is to be observed from time to time, however, and, as the foot grows in its original inclination to varus, it will, after the lapse of two or three more years, have to be kept in proper position, under the rapidly increasing weight of the body, by a walking-brace adapted to its needs, for another period of two or three years. When the foot is full-grown it will be shapely in appearance and practically perfect in its ability to perform all the duty of a foot congenitally normal.

Although congenital club-foot has been chiefly kept in mind in the above pages, the views expressed in regard to the influence of the weight of the body are applicable also to talipes varus of paralytic origin. In this affection, at an early stage and before the foot has lost its flexibility, a simple walking-brace is needed, as in Figs. 19 and 20, to properly direct the action of the weight of the body on the paralyzed foot. At a later period, if this measure has been neglected, and the foot has been allowed to become varus and more or less inflexible, the case will require more attention and probably prolonged effort, with multiple straps and adhesive plaster, to carry the foot across the line between deformity and the norm to the position in which the weight of the body shall be a correcting and not a deforming force.

THE NECESSITY FOR MECHANICAL TREATMENT AFTER OPERATIONS FOR CLUB-FOOT.

By W. R. TOWNSEND, M.D.,
NEW YORK.

Of all classes of club-foot presenting themselves for treatment, none are more troublesome and difficult to manage than the cases that have been operated upon and relapsed. Many causes exist for the relapses and for imperfect results, but both in private practice and in the dispensary we see quite a number of cases where a failure to follow an operation by proper mechanical treatment is the sole cause. All writers on orthopedic surgery are agreed as to its value and necessity, yet we constantly see cases where no appliance has been used after an operation, or where it has been used for so short a period as to be of little or no real value.

At the outset it must be clearly understood that whatever operation has been performed, no mechanical treatment will produce a good result if the operation was imperfectly done, and these cases give us the imperfect results, not the relapses. Bradford and Lovett state that the obstacles which prevent perfection in result are: Imperfectly divided tendons; imperfectly divided ligaments or plantar fascia; imperfectly stretched ligaments; incorrect relation between the scaphoid and anterior facet of the astragalus, due either to anatomical alteration of shape of astragalus, or to imperfect division or stretching of the ligaments which bind these bones together in the deformity. We might also add to this list—insufficient removal of bone in cuneiform osteotomies of sole of foot, for if the foot connot be over-corrected at the time of operation, the final result will not be perfect; in rare instances the over-correction is carried too far and a new deformity is produced, such as a valgus after operation for varus, but this mistake occurs so seldom

it is scarcely worth mentioning. Again, operations may be perfectly done, yet the after-dressings of plaster-of-Paris or water-glass or leather are so imperfectly applied, or padding is so badly put in, that the foot is not held in the best possible position, and an otherwise good result is ruined. The deformity should be over-corrected at time of operation and firmly held by the dressings, and then if mechanical appliances are kept on a sufficient length of time, the result ought to be good; but if we do away with our braces too soon the cases will relapse.

Bradford and Lovett state that there appears to be no greater liability to relapse after complete correction by mechanical means than when tenotomy is employed, and I believe nearly all surgeons are agreed upon this point. At all ages, no matter what the operation, there are many factors present for a long time afterward which have a tendency to produce a relapse. In the congenital cases, if contraction existed in the soft parts and a simple tenotomy were done, although the division of the tendon permitted the foot to be straightened and deformity corrected, yet the shortened tissues need many months of stretching and retention by apparatus before all tendency to contraction is overcome; if the ligaments and deeper tissues were affected, the same is true, and in the more severe cases where there was bony distortion, the necessity is still greater. Where the child has not walked, the weight of the foot will often cause the toes to drop; and if the posterior muscles are stronger than the anterior, a condition of equinus may supervene even after a successful operation. All cases that have had tenotomy prior to the time they walked on the foot should have a proper brace and wear it for a year or more, as it is very important that the tarsal bones, as they grow, should articulate properly one with another and that the weight should be transmitted through the normal facets, and that if any new or faulty ones had formed or if distortions exist in any bones, that they be kept from exercising any influence, or as little as possible, on the final result. If the case is operated upon at a later age where bones have become markedly distorted, the necessity for retaining the foot in proper position for a long time is very urgent, for here some ligaments have become stretched and others contracted, and to restore these to their normal condition is always a slow, and in some cases almost impossible pro-

ceeding, and unless this occurs as soon as mechanical appliances are removed a relapse occurs. The faulty articulations and distortions of the tarsal bones are still greater, and more time is required to get them into a condition where the deformity will not reappear than in children who have not walked. Again, in many of these cases secondary deformities at knee and hip have occurred owing to the faulty manner of walking, and these still exist, although in lesser degrees than before the operation, and have a tendency to cause a relapse. The condition of the muscles is also very important, for while some have been unduly stretched, others have been contracted, and much time is required for them to regain their normal tone. All apparatus used should aim to cause muscles to act in normal directions, and to allow the weight of the body to be properly transmitted through the feet, and thus aid in the correction of the deformity.

Where wedges of bones have been taken from the sole of the foot, as in the operation of Davies-Colley, if sufficient bone were removed at time of operation, the danger from relapse is slight and depends mostly on the condition of the soft parts and muscles, as the slight motion between tarsal bones is lost on side of operation, and several bones may become ankylosed together and thus prevent relapse.

In all forms of paralytic club-foot after operation, apparatus must be kept on for a very long period, and in fact, many cases should never leave it off. If, for instance, the anterior group of leg muscles is atrophied, causing an equinus, as long as a brace is worn and heel is kept down, foot may remain in excellent shape, yet as soon as apparatus is removed, the lengthened tendo Achillis, meeting with no resistance from the anterior group of muscles, again contracts and a new condition of equinus follows. The same is true of calcaneus, and where the operation of Willets has been done, either a brace or properly constructed shoe with raised heel, and a steel tongue or heavy leather tongue in front, must be always worn, or after a varying period of one or two years the tendon will again stretch and the old deformity will recur.

In both classes of cases, the congenital and paralytic, the relapsed cases are very troublesome to treat, as usually the inversion is very marked, or of a difficult kind to correct, and the equinus causes a certain amount of twisting of os calcis that requires long treatment.

Of course, in correction by operation of paralytic cases of club-foot, deformity should not be over-corrected, but foot put up in normal position.

Whilst it is recognized that these views are held and taught by many surgeons, yet the large number of relapsed cases of club-foot seen yearly at the Hospital for Ruptured and Crippled suggests the importance of after mechanical treatment for a period of several years rather than of several months, and the laity and medical men should clearly understand that operations for club-foot are but the first step in a long course of treatment.

After operations for club-foot, apparatus should be maintained always in paralytic cases, except in rare instances, and in congenital cases until such time as the patient can walk easily by placing the entire sole and heel flat on the ground and without inversion of the foot. If when brace is removed, even though it be several years after the operation, the foot shows any tendency to relapse, reapply some form of apparatus and keep it on until all deformity remains corrected. We must, however, remember that many of the so-called relapsed cases should be classed among the imperfect cures, and that in all cases cure cannot be completed until from one to three years after operation, according to severity of case and operation performed. And by advising that apparatus be kept on, it is meant that it be worn night and day. In many cases where braces are attached to the shoes, as soon as these are removed the foot assumes a faulty position; and although the damage done while the child is in bed is not as great as when walking about on the distorted foot, yet I have seen cases where relapse was due to no apparatus being worn at night. If braces are attached to shoes, other braces should be provided to hold the foot in proper position at other times, and at no time should the feet be without proper support.

CONTRIBUTION TO THE TREATMENT OF CLUB-FOOT.

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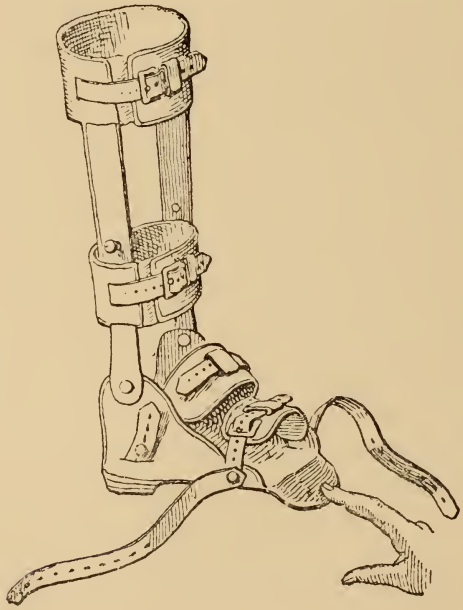
The manifold methods of treatment—apparatus, bandaging, manipulations, and operative procedures—recommended and used in the treatment of congenital pes varus might, to an outsider, appear

Fig. 1.



as a proof that the treatment of this deformity is still, to a great extent, vague and lacking in the necessary scientific and empirical basis. Those who are constantly engaged in the treatment of deformities, and who are familiar with the nature of the lesion in

question, know, however, that this variety of methods is less the expression of uncertainty than of the special difficulties which the treatment of pes varus has to conquer, and of a number of individual peculiarities in every single case and in every single orthopedist.

It is not only certain that the congenital pes varus can be cured—this especially holding good without any restriction in cases where continuous treatment can be applied before the epiphyseal growth has stopped—but it is also beyond any doubt that this result can only be obtained when methods of treatment founded entirely on experience and deduction are serving us as a common guide, however different the methods or means are which each individual applies in their execution.

These remarks apply especially to the principle generally accepted nowadays, and adopted in cases which come under treatment directly after birth, the so-called American or Sayre's doctrine, according to which congenital pes varus should be treated as early as possible. Both experience and theory furnish weapons to defend the correctness of this doctrine against that of earlier surgeons, who held another opinion upon this subject.

This also applies to the principles followed in the treatment of pes varus at a more advanced age. In these cases the treatment may consist in forcible reduction by the hand or by one of the many apparatus in use, by "Etappeverbindung," by subcutaneous division, or by "open incision." The rule for the treatment is in all cases the same, viz., that which obtained a broad scientific base in Jul. Wollf's "law of transformation," which might be shortly expressed in the maxim: 1, Bring the osseous parts into their mutual normal position; 2, keep them in this position; and 3, make them act in this position.

Convinced, as I am, of the correctness of this fundamental principle as a guide for our treatment, and acknowledging the importance of the excellent scientific foundation which the "law of transformation" offers orthopedic science and treatment, I am equally sure that it is necessary to choose but those methods of treatment which allow us to follow the above-mentioned threefold injunction, and to reject, or modify, those which prevent its consequential accomplishment.

All methods of treatment must be tested and valued from this point of view. However, but one of these, viz., the immobilization

by fixed bandage, which is so extensively used in the treatment of club-foot, will be tested here, mainly as giving an illustration.

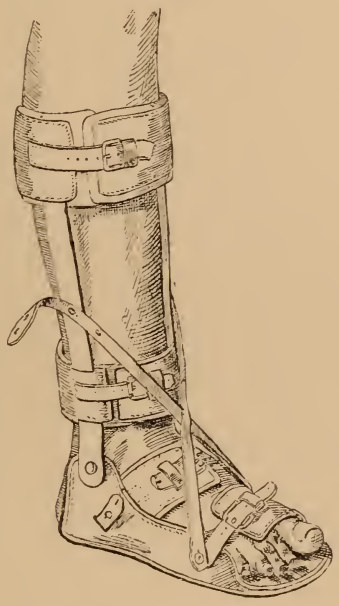
A pes varus having been corrected, *i. e.*, the first demand of the above injunction having been complied with, a fixed bandage made of plaster-of-Paris, or other plastic material, may be of assistance to carry out the second, *i. e.*, keeping the foot in the corrected position. As far as the third demand is concerned, *i. e.*, the performance of the normal function, the fixed bandage, however, fails entirely. It actually impedes the function; it not only keeps the talo-crural articulation, but also all the minor joints in front of this, fixed, and simultaneously the whole apparatus acting in the movements of these joints (muscles, ligaments, vessels, nerves, etc., and even the nervous centre implied) are kept inactive, not for days and weeks only, but for months, and even for years. If, then, the "transformation" of the deformed osseous parts of the foot not only depends upon normal position, but also upon normal function, the protracted immobilization must be an obstacle to the "transformation" of the club-foot. Besides, or rather consequently, immobilization has an inseparable companion, viz., atrophy, the result being an augmentation of the atrophy which in all cases exists prior to treatment. Accordingly, after the discontinuation of the long-lasting immobilization a protracted and energetic battle has often ineffectually to be fought against this obstacle to normal function. Furthermore, the fixed bandage has an active influence in compressing the tissues it encircles. If we needed proof of the considerable, and often very destructive, consequences of long-lasting compression connected with immobilization, the sad experience obtained by removal of the so-called "Dauerverband," in cases of minor surgical lesions, supplies ample material; but the examination of the stiff, pasty, thin, atrophic pes varus, which has been retained in a fixed bandage only for four to five weeks (not to mention three months), speak distinctly enough in that respect.

These considerations lead us to the conclusion that protracted immobilization is a method to be rejected in the treatment of club-foot. I have for a long time—long before the "law of transformation" furnished me with theoretical arguments—abstained from using immobilization for a longer period than eight to ten days, for instance, never longer than until the tenotomy wound was tolerably healed,

and I have taught others to act in the same manner. At the same time, I have endeavored to construct a retentive bandage, or splint, which was able to keep the corrected foot in position, without incurring the drawbacks of immobilization, and I think I have succeeded in this in the splint illustrated above.

It will be seen that the apparatus consists of two pieces, the junction of which is situated exactly in the plane of the talo-crural articulation, and of which the one forms a double splint for the anticrus, while the other is a plate-shaped splint with bent rims for the

Fig. 2.



foot. The foot-splint must fit the foot exactly, and must not reach farther than the bases of the toes; it is furnished with two straps, which go through the splint on the edge between the plate and the bent rim. Of the two straps, the posterior acts on the talus region from the external side of the foot, while the anterior exerts a traction on the anterior part of the foot from the internal side of the foot. Besides, two elastic bands are attached at the extreme front of the foot-plate, intended to be fastened to the crural splint after cross-

ing on the foot. In this whole splint we have an apparatus which can act with great force upon the reduced club-foot in all three deviating directions: the posterior traction, which acts upon the talus region counteracts the deviation toward supination; the anterior counteracts the adduction; and the elastic bands the plantar flexion. Besides, this splint does not hinder the natural function; walking (including the disengagement of the foot from the ground) can take place normally. Further, the splint can be removed at pleasure, for dressing, manipulation, shampooing, etc.

Of course, it is impossible for me to say whether this splint will prove as useful to you, gentlemen, as it has to me. However, I am certain that you will agree with me in saying that "immobilization is incompatible with transformation."

COMPARISON OF OPERATIVE METHODS IN THE TREATMENT OF CLUB-FOOT.

By DE FOREST WILLARD, M.D.,
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Taking it for granted that mechanical measures have been properly tried, and that the time has arrived in which some form of operation for club-foot is demanded, the consideration of the proper method of operation is of great importance.

Very young infants should not be subjected to operative treatment except in the few cases where the deformity is so great that the retention of mechanical appliances is difficult and the social condition of the patient so poor that proper care is impossible. Whenever, however, the time for walking arrives, and the cure has not been sufficiently advanced to permit the sole of the foot being brought squarely upon the floor in walking, operative measures should be instituted in order to secure the best possible position for the foot and to bring into play the powerful agency of the child's locomotive movements. Such movements are of exceeding importance in the cure of malformations of bones and in the process of development of the muscles.

The question of time and method will vary in each individual case, with the amount of deformity, the state of the patient, the time that can be given to treatment, and many other minor conditions.

The operation to be selected will depend largely upon the age of the child. An infant foot is altogether a different thing from the same member in a boy of fourteen.

All practical surgeons will agree that no one operation is suitable for all cases. The one object to be gained is to bring the foot as far as possible into the normal position and to restore its normal functions. This can be accomplished as follows:

I. By forcible replacement with subsequent retention.
II. Free subcutaneous division of all contracted tissues with forcible straightening and subsequent retention.
III. Open incision of all contracted tissues.
IV. Tarsectomy.

I. *Forcible replacement* may be applied in various ways, either in a moderate degree, by stretching the ligaments and tissues; or it may be carried to the extreme point of tearing the ligaments, fasciæ, etc. Anæsthesia is necessary. The operation should be thorough and complete. When moderate force is needed, the hands of the physician alone are sufficient. When the force required is extreme, then a fulcrum, consisting of wood, a firm sand-bag, hard rolled bandage or other contrivance may be employed. A tarsoclast or wrench may be used when the hands of the surgeon are not of sufficient strength to complete the rectification. With an educated touch and good judgment serious accidents are rare. It will occasionally happen that the epiphysis will be ruptured or a leg broken by the force required, if the force is not applied in the right direction; but the fault then will be not in the method, but in its employment.

All the contracted tissues must be elongated. In extreme cases, where rupture or tear of the ligaments occur, the result is no worse than if open incision had been practised originally.

This method is especially applicable to young children, or to those of larger growth in whom the deformity is slight.

The application of forcible stretching by mechanical traction devices is often of value.

II. *Free division subcutaneously.*

Personally, I am not in favor of extreme force alone, but prefer the preliminary free division of the tendons, fasciæ and all resistive structures. The degree of force to be employed will necessarily vary according to the amount of the deformity. The foot must be brought into the straight position, and it must be retained in that correction. The misshapen bones must be moulded into their proper shapes, and this requires the application of a large degree of force, especially if the child has been walking for years in a false position.

The object of the treatment must be to bring the foot into such

position that the effort of walking will tend constantly to mould the bones into their normal relation as a support for the body. Each bone has its proper function, and in its natural shape it best performs its destined object.

It has been objected that compression of the tissues over a hard fulcrum is liable to produce sloughs. This rarely happens. The compression is of short duration. Rupture of the skin and tissues on the concave side of the arch seldom occurs.

My rule is to first divide everything that prevents rectification of the foot. This division, of course, will vary according to the amount of deformity. In my opinion, however, even in young children the error is in cutting too little rather than too much. Section of the tendo Achillis can necessarily have but little effect upon varus, save as it permits the foot to be brought flat upon the ground, and there is less mechanical disposition to in-turning of the toes during locomotion. The tibialis anticus and the tibialis posticus are both strong tendons, strong proportionally even in infants, and as their antagonistics, the peroneals, are often paralyzed, there is reason to fear that the patient will relapse into the position most easily assumed, unless thorough rectification is established.

The metatarsal bones in their relation to the tarsals frequently slope inward, and it is almost impossible to overcome this tendency, either by operation or mechanical measures.

A strong tenotome, with long cutting face, is introduced beneath the skin of the foot, and turned sidewise, and everything is divided directly down upon the tarsus; if necessary, every tendon and ligament may be severed. A subcutaneous incision offers the advantage over an open wound that all elements of suppuration have been excluded; the cure is much more rapid even with the strictest antisepsis, and a bad scar is avoided.

Every contracted tissue, whether fascia or tendon, should be divided. We need have but little fear of the plantar artery. If it is injured in the sole it is easily repaired, and I have never seen a foot become gangrenous.

A free division saves time, lessens pain, and decreases inflammatory deposits. The plan of immediate rectification is one worthy of attention. The amount of force which can be employed in a case of club-foot of several years of age is very great, and it requires a

strong man to accomplish good results. One can either twist the foot to a straight position with his hands, or he may use a fulcrum of wood, a sand-bag, a hard-rolled bandage, or other material, or a tarsoclast.

Division of the contracted tissue is of itself utterly insufficient to secure rectification. In cases of several years' standing, where the ligaments of the concave side have become shortened, and the tissues upon the convex side are lengthened, the skin must be stretched and elongated and the fascia must be torn. The misshapen, misplaced, and badly shaped bones must be adjusted, and this can only be accomplished by force. In many instances this must be extreme in amount. Not only are the tarsal bones distorted, but the metatarsal in their relation to the tarsal have been been forcibly pushed out of shape by the continuous traction at the articulation of the tarsus. Great inward obliquity is everywhere present, and is a deformity which can never be entirely rectified.

In certain cases in young children manual straightening is possible, but in older cases instrumental assistance is necessary. A strong surgeon can accomplish much. With an educated touch and good judgment serious accidents will be rare. When force in the wrong direction is applied without discretion, rupture of the tendons and tissue may result. Whatever fulcrum is selected, pressure should be exerted to such an extent that complete rectification will be possible, and all the tissues on the contracted side of the foot must be elongated.

Even when firm pressure has been made over a wooden block sloughing does not follow.

Whenever the skin is sufficiently distensible to permit of complete straightening, it had better be done at one sitting. On only one or two occasions have I have seen the integument in the concavity tear; should this accident occur, the surgeon has simply to make a clean incision, and no more injury is done than if the open method had been primarily attempted.

It seems very absurd to American surgeons to divide contracted tissues and then permit the foot to remain in its deformed position. Malposition is not correction. If the foot is brought to its normal position and fixed there, Nature will quickly throw out the requisite amount of material, and a good walking tendon will be secured. If a

faulty position is maintained for ten days, it is very probable that only a minimum amount of repair tissue will be poured out, and when this insufficient material is stretched in placing the foot in its proper position a feeble tendon will naturally result.

One great cause of inflammatory pain and swelling will be removed if the foot is absolutely fixed in complete correction.

No appliance or splint is so comfortable and so easily adapted as a plaster-of-Paris bandage. Care should be taken that an assistant firmly grasps the foot and leg in such a manner that the deformity can be over-corrected by eversion and flexion, and that his hand shall not interfere with the application of the plaster bandage. It is tiresome to maintain this position during the application of the bandage, but it should be accomplished, as it is very essential that no indentation should be made in the plaster while it is soft, since each depression means a subsequent rigid counter-elevation on the inner surface of the cast, often causing great suffering and even sloughing.

If the surgeon would save himself from subsequent labor, he will use a strip of lead beneath the plaster, and will cut down upon this strip before the gypsum is hard, thus saving himself hard work with saw and knife in the future. From half an inch to two inches should be left at the ends of the cast. If these ends are left the strength of the cast will not be interfered with.

III. *Open incision.*

When the tarsal bones are not seriously deformed and the contractions are chiefly limited to the soft parts of the concavity of the circle, it has been proposed by Phelps and others to divide these tissues freely by open incision in preference to the subcutaneous method. The operation consists of making a diagonal incision, then cutting through each layer until all the contractions have been relieved. This may necessitate the division of everything upon the concave side of the curve, even the ligaments. The rule is simply to divide every structure that prevents rectification of the foot.

It is sometimes a good operation and permits of straightening, but it is open to the objection that the same amount of division can be done subcutaneously, and suppuration rarely, if ever, occurs. This operation has its disadvantages. The wound must close by granulation, the time of healing is long, and the resultant scar makes a

deep furrow on the surface of the foot much more ill-looking than the one remaining after subcutaneous section. Rarely the skin sloughs after free subcutaneous division of the tissues, but this is seldom. Of course, antiseptic methods should be employed to facilitate the rapidity of healing.

IV. *Tarsectomy.*

In adults and in walking children who have been for a number of years with their feet in a deformed position, great alterations of the bony structures are present.

The removal of the individual bone or bones will often permit complete rectification. The surgical methods employed include up to the present time sixteen different operations. Wedge-shaped excision of the outer side of the foot, without reference to the relation of individual bones, has been largely practised. The shortening of the outer side of the foot is an objection, and the exposure to infection of an extensive surface of cancellous tissue increases the gravity of this operation. It is too mutilatory, and it has been largely replaced by excision of the astragalus and other methods.

Removal of the astragalus is especially applicable to those cases where the bone has been twisted on its long axis and partially displaced forward. The incision should commence below the external malleolus and pass forward so as to avoid tendons and vessels. The bone is then removed from without inward by means of a dull-edged elevator knife and lion-jawed forceps, great care being taken to avoid wounding the posterior tibial artery upon the inner side.

The calcanus is sometimes too wide to be received between the tibia and fibula, in which case the external malleolus may have to be removed.

Excision of the cuboid, alone or in connection with the astragalus and scaphoid and a part of the calcaneum, is frequently recommended.

Osteotomy of the neck of the astragalus has been recommended by Bradford and Lovett, and osteotomy of the os calcis has been advised.

Extirpation should be regulated by the necessity of the case. Complete rectification had better be secured at the time, if possible, since all children dread surgical operations and dread the taking of

ether. Whatever, therefore, can be safely done should be performed at one séance.

Conclusions:

1. Young children up to the age of walking should, as a rule, be treated by mechanical measures. Operative measures in this class are necessary only when the foot is so deformed that apparatus cannot be retained, or when the parents are unable or unwilling to give proper care to the appliances.

2. Simple tenotomy in young children is usually sufficient.

3. A large majority of moderately deformed feet in children between the years of one and fifteen can be effectually straightened by powerful manual strength after multiple tenotomies. The rectification should be complete at the time of operation, and, as far as possible, the bones should be brought into proper position.

The difficulties in immediate rectification sometimes depend, not upon the age of the child, nor upon the deformity of the bones, but upon the great rigidity of the foot. In children past twelve and in adults necessarily a great amount of force must be applied.

4. Subcutaneous section heals more rapidly and leaves less scar than open incision.

5. Open incision is especially applicable to those cases where there is great contraction of the tissues of the concavity of the arch without serious deformity of the bones.

6. Tarsectomy, as a rule, is not justifiable in children under five years of age. In a rigid foot, or when the deformity of the bones is excessive, or when it is important that a cure should be completed at once, or when the patient has reached adult life, removal of some portion of the tarsal arch often offers the surest means of rectification, and renders the foot less liable to relapse. The loss of normal function is not great. Excision of the astragalus in well-selected cases seems to interfere least with the subsequent functions of the tarsus, and gives a good walking foot. Wedge-shaped tarsectomies are only occasionally required.

THE TREATMENT OF INFANTILE CLUB-FOOT.

By E. G. BRACKETT, M.D.,
BOSTON.

The treatment of infantile club-foot differs from that at later periods, in that it has to deal with bones in a soft and cartilaginous condition, and also in the fact that there is the rapidly growing period, during which the formation of the various structures are influenced by the position in which the foot is held, and advantage may, therefore, be taken to bring about a normal growth rather than to correct at once an abnormal position. In these small feet, without doubt, the condition of the soft parts—that is, of the muscles and ligaments—is the most important obstacle to the restoration; but the contraction is only a part of this abnormal condition, at least so far as permanency of a perfect result is concerned. But of equal importance is the necessarily elongated condition of the opposing structures which should form an equal obstacle to the return of a corrected foot to its old position, and, therefore, this elongated condition of antagonistic parts must be taken into as thorough consideration; otherwise, after a complete correction of a distorted foot, there are no structures which will hold it in its corrected position and insure the permanency of a perfect cure. Simple correction by no means constitutes a perfect cure; for if it is possible for the foot to return to the abnormal position, this will be assumed whenever the corrective force is removed, and a relapse more or less complete is only a matter of time.

The object of the treatment is to bring about an equalization of all the structures, and to accomplish this it must be persisted in until this change becomes complete—that is, the shortened structures must be elongated until they no longer form an obstacle to complete correction, and also their antagonists must be contracted so

that they serve as an obstacle to the return of the foot to its original deformed condition; and to accomplish this, the foot must not only be brought to an over-corrected position, but must be held there long enough for this change to take place; and this should be persisted in until the foot, when at rest and influenced by gravity only, or when put into active use, as in walking, shows no tendency to assume the distorted position.

The distinction must be made between a corrected foot when in an active or in a passive condition. The complete correction, or even over-correction, of many of these feet is possible without the use of any force at a time when the foot if left to itself or put into use assumes a badly distorted position. This is more particularly noticeable when the foot is used, and by muscular action the foot is drawn strongly toward the direction of its old malposition; and if left in this condition without the use of firm retentive appliances, the foot is gradually drawn around until the old distortion is nearly as great as at first. If the free use of the foot is allowed, although held by appliance, before the condition of the soft parts is such that a return is not possible, this use, which strongly tends to the development of the distortion, is greater than the corrective force which is applied through the appliance, and therefore relapses may occur, even though the care of the foot is not relaxed. The only test which is of value in determining when apparatus shall be entirely discontinued, is the position of the foot when left to itself, during the act of walking. So long as there is any tendency to the return of the deformity in any direction, and until there is decided resistance to a force applied in this direction, it is not safe to omit retention apparatus.

In the correction the character of the deformity must be borne in mind, namely, the distortion of the foot itself, and the malposition of the foot regarded as a whole, in reference to the ankle-joint; and these two conditions must receive separate attention. The distortion being, in the first place, the twist of the foot upon itself, that is, the anterior part upon the posterior; second, an inversion of the anterior part at the medio-tarsal joint; and third, the malposition or the inversion or change in the relation of the foot as a whole in reference to the ankle-joint.

The most common defects of imperfectly corrected feet, or of feet

which have been corrected but have relapsed, are, first, the inversion of the anterior portion of the foot or the toes; second, the depression of the outer border of the foot, as seen by the resistance of the cuboid. The former position is the most persistent, and is often seen only when the foot is put into active use—that is, there is no resistance to the complete correction, even without the use of force, when the foot is in a passive condition; but when left to itself, or, more particularly, when the muscles are brought into active use, as in locomotion, the foot is twisted toward its old abnormal position. The reason of all this is obvious. Although the correction has been carried to completeness, the elongated structures offer no resistance whatever to the return of the foot when left to itself, and the weak and but little used muscles are not brought into equal action with their antagonists.

All methods of treatment have but one object in view, and that is to bring about the restoration of the normal shape by means of the elongation of these shortened structures and the contraction of the opposite—and this without reference to the means which are used or the time employed, whether by a gradual and expectant means, or whether by rapid and forcible means, as by operation.

The treatment of these earlier cases can be divided into the following methods: slow, expectant method, as by means of bandages, plaster, or continual extension, which has for its object the gradual stretching, and with this the gradual change in shape both of bones and soft parts; and the radical measures which have for their object the more rapid restoration of the normal shape, with the retention of the corrected position while the change in shape during the process of growth may occur. In the former the retention after the correction is not required for so long a time, as the change is brought about more gradually, and, therefore, when this is accomplished the anatomy is nearer the normal; but in the latter, when the change is brought about at once, the foot must necessarily be held in this over-corrected position for a much longer time, that during growth the change in the shape of the structures of the foot may take place. Both methods have their advantages, and frequently the preference can be given to one or the other with reference only to the individual case or the circumstances of the individual.

The method here advocated, which appears to be applicable to a

large number of cases, is the gradual restoration of the distortion by means of frequently applied bandages, and the correction of the malposition later by operation. By this means the operative part is made as slight as possible, and but little force is required to bring about a complete over-correction. Another advantage is that it bridges over the period in the first few months, during which it is very hard, on account of the small size of the foot, to hold by any form of apparatus, and at the same time a steady gain is made in the treatment during this time. In the corrections the three directions of malposition are corrected in order; namely, inversion at the ankle-joint, inversion of the anterior part of the foot, and the equinus; and the plasters are applied at intervals of from two to four weeks, and at each application the foot is brought nearer to the normal position.

Treatment may be continued until the child is nearly ready to walk, unless the circumstances of the case make it seem advisable for an earlier operation. The objection to early operation is the difficulty of holding the foot by any form of splint when the foot is so small, and the consequent danger of relapse. The objection to continuing the plaster for so long a time is merely that of the additional work and care. The inversion, both at the anterior part of the foot and at the ankle-joint, is nearly or quite corrected before the operation, and little force is needed to overcome the equinus and complete the correction.

The operation consists in tenotomy of the plantar fascia, of the astragalo-scaphoid ligament, and of the tendo Achillis, and sometimes of the abductor pollicis muscle, and the foot forcibly brought into an over-corrected position. The amount of corrective force necessary at the time of the operation is, of course, dependent upon the degree to which the correction has been carried by plaster, but in nearly all cases but little is required. After correction the foot is placed in plaster, as in the usual way after operations, and there remains for from four to six weeks.

It is the after-treatment of these cases which is probably the most important. Unless the foot is perfectly held in a corrected or over-corrected position, and for a long time after any tendency to recurrence is noticed, a relapse is almost certain. On account of the size of the foot and difficulty of applying apparatus in so young children,

the relapses, even with a complete correction, are by no means rare. If the ordinary retention brace is used, which is applied daily by the attendant or parents, the foot almost invariably slips in the apparatus, so that, although to all appearances it is held, the child is in reality using the part in its abnormal position, with the constant tendency to the return of the distortion.

A ready means to obviate this difficulty is the retention of the foot in some form of apparatus—preferably a Taylor club-foot shoe—by means of a silicate or plaster-of-Paris bandage. By this method the foot can be held firmly and securely to the apparatus in the position that is desired, and without difficulty. In a small foot, the straps which are usually applied do not perfectly hold the part in a correct position, the difficulty being not only in holding down the heel, but in forcing up the outer border of the foot. From this the relapse occurs: more commonly in the direction of inversion and in the equinus.

The advantage of this method is in the surety that the apparatus is always correctly applied—that is, it is not left to the judgment of inexperienced persons and away from the observation of the attending physician. Another advantage lies in the fact that a small foot is more easily held by any form of apparatus which grasps the whole foot than by a few straps which make pressure over certain parts.

The foot is wrapped in a thin layer of cotton or with a gauze bandage. For a few applications at least it is well to apply a piece of adhesive plaster along the back of the leg and fasten this to the sole of the shoe, in order to keep the heel firmly upon the plate. With the foot then held with firm pressure against the sole-plate, the bandage is placed around the instep and the heel secured to the shoe. The anterior of the foot is then held to the anterior of the sole-plate by a few turns of the bandage, the upright forced back, and the ankle bound to it. In some cases it would be found that the foot slips in the plaster—that is, turns in the same way that a club-foot will turn in an ordinary shoe—and in such cases adhesive plaster may be necessary instead of the stiff bandage. The apparatus is worn, applied in this manner, until the child is walking well and the foot shows no tendency to resume its former position, when the apparatus is removed and the foot left to itself.

GENERAL DISCUSSION ON CLUB-FOOT.

Dr. L. A. Sayre said that for many years he had held the opinion that the treatment of congenital club-foot should be begun immediately after birth. The usual delay in instituting treatment is largely due to orthopedists not impressing upon the profession at large the fact that they can themselves without difficulty carry out the treatment necessary at this early stage, and hence they are responsible for many deformities which might be prevented. The text-books also tend to foster this inclination to temporize, and therefore the sooner this Association declares itself clearly on this point, the sooner will there be a perceptible decrease in the number of these preventable deformities.

The best instrument for carrying out this treatment is the hand, whether the condition be varus, valgus, equinus, calcaneus, or the various complications. If the child's foot be taken in the hand, and gently forced toward the normal position, it will be found that the circulation of the part at once becomes impaired, and if the foot be not soon released, sloughing will occur. Having now released the foot, the same manipulation is repeated on the other foot, if this be also deformed. After carrying out these manipulations a number of times, during a period of about one hour, it will be found that the foot can then be placed almost in the normal position without seriously interfering with the circulation. Having accomplished this, the foot is then held in this position by any convenient retentive appliance. These manipulations are to be repeated day after day, and the mother or the nurse can be easily taught how this treatment is to be carried out. After awhile artificial aid may be necessary, and then a piece of sole-leather, after soaking in water to make it pliable, may be moulded to the foot, which it will then retain in the desired position. This leather stocking may be altered from time to time to keep pace with the improvement gained, and when the point is reached that the child is able to place the foot flat on the ground, walking will usually complete the cure. The speaker had been accustomed to employ whenever practicable elastic tension to take the place of paralyzed muscles. If a spastic condition be present, stretching should be done, unless it interferes

with the circulation, in which case the resistant part must be cut. If on making "point pressure" on the stretched tissue, a reflex spasm is produced, it is an indication that the part has been elongated to the fullest degree, and, therefore, that cutting alone is indicated. The age is a matter of indifference, so long as this indication is present. Having divided the resistant tissues, the parts are placed in a slightly over-corrected position at once, and after about two weeks, or when firm union has occurred, stretching may be begun. This is much better than the old plan of performing tenotomy, and beginning the stretching within four or five days, for such a procedure results in the production of a thin ribbon-like tendon. After this, almost any retentive apparatus, in conjunction with proper exercise, will be all that is necessary. A very large majority of cases of congenital club-foot, of whatever variety, can be successfully treated in the manner described without operative procedures. The retentive apparatus should be as simple as possible, and for the poor nothing is better than plaster-of-Paris; but in order to prevent atrophy, the plaster casing should be removed every week or ten days, and the parts well shampooed. Later on, a plaster-of-Paris boot, with the sole rounded like a roller skate, is a very useful walking appliance. In aggravated cases, where the bones have become permanently altered in structure, one should do a cutting operation, dividing, as Dr. Phelps does, everything which offers resistance to reduction, and, if necessary, removing the bones, although in most cases the removal of the astragalus can be avoided. If the treatment above outlined is carried out properly and efficiently, he thought there would be no relapses.

Regarding the method of wrenching described by Dr. Ridlon, he could only say that he saw no good reason for such cruel treatment in this age of anæsthetics. It seemed to him that the operator's eyes should be a sufficient guide without requiring the consciousness of the patient.

Dr. Nicholas Grattan said that he had been greatly interested in the discussion, but he had observed that nothing had been said about the condition of the legs in club-foot. Of late years he had been treating suitable cases by fracturing the tibia just above the ankle, and also still higher up, and had succeeded in many cases in

curing the inversion. His retentive apparatus consists of a piece of hoop-iron, fastened by adhesive plaster to the posterior aspect of the limb, and extending underneath the foot. The foot is kept everted and flat. The after-treatment consists in applying elastic bands to pull the foot outward, and in making the child go around bare-foot.

Dr. A. M. Phelps said he had listened with especial interest to the paper of Dr. Bradford, and, in the main, we could all heartily indorse the opinions which it expressed. Dr. Bradford proposed forcible correction, aided by tenotomy or open incision, and failing in this, the removal of the astragalus, or of a V-shaped piece from the os calcis. All of this, the speaker said, he had published more than eight years ago in a paper before the Eighth International Congress; and he had also embodied in his papers the principle of forcible correction with the plaster. He laid special claim to the following mode of procedure, viz.: When it is decided an operation is necessary, one must operate until the foot is straight, and the successive steps from the milder to the more severe are—(1) forcible manipulation; (2) subcutaneous tenotomy; (3) open incision; (4) linear osteotomy through the neck of the astragalus; (5) removal of the cuboid and scaphoid bones; and (6) if the foot still cannot be placed in the straight position, it is better to perform a Pirogoff amputation, which gives a useful stump. He had, however, never been compelled to resort to the last step. There is a twofold reason for the open incision: (1) the skin is short, and must be lengthened; (2) we can in this way intelligently cut ligaments, fascia, bone, or whatever parts are resistant, not stopping until the foot can be placed in a super-corrected position of calcaneo-valgus.

The speaker also thought Dr. Bradford was extremely unfair when he ascribed to the operation the tenderness of the foot observed in the patient presented by Dr. Phelps; for we all knew that when the foot has not been stepped upon for some time it is always sensitive. Dr. Bradford suggested that the foot would have been more quickly healed if the twister had been applied. The speaker could not comprehend how the twister could make the sole less sensitive, or how the lacerated wound produced by this instrument could be expected to heal more rapidly than an

incised wound. He was sure Dr. Ridlon could bear testimony to the fact that at the operation it had been necessary to use a force of at least two hundred pounds to pull the foot into place, even after extensively dividing the resistant tissues. Regarding bone operations, he would like to state that no one, in his opinion, is justified in performing such an operation until all the milder measures have first been tried, for statistics show that in 90 per cent. of all cases it is possible to straighten the foot without operating upon the bones, and it must not be forgotten that the mortality from bone operations is from 3 to 5 per cent. It is just as sensible to ligate the femoral artery for hemorrhage from the plantar arch, as to operate on the bones in the vast majority of cases of club-foot. The idea of utilizing the weight of the body to correct the deformity is an excellent idea, but is not new, as he had embodied it in a paper which he read before the Congress in Copenhagen as long ago as 1884. The method by continuous leverage did not seem to him as good as the manual method described by Dr. L. A. Sayre. The question had been raised as to when the treatment should be begun. Personally, he thought the proper time was just as soon as the afterbirth had been removed from the mother. Rubber muscles and similar contrivances are not sufficient to overcome the deformity.

Dr. James E. Moore thought they were all agreed that club-foot in young children could be treated successfully in a number of different ways. His first experience with the treatment of resistant cases was according to the measures advocated by Drs. Bradford and Phelps. The patient was an adult, twenty-eight years of age, who had been referred to him by a reputable practitioner with the idea of having the foot amputated. The speaker demurred and explained that the deformity could be reduced, but the patient insisted upon the amputation, as he said he had been told the same thing about curing club-foot many times before. After much argument he finally agreed to be operated upon, but said, "When I wake up, I want to find the toes turning out, or no foot there." Several tenotomies had been done previously, so the open incision was at once resorted to, but without result. Then an osteotomy was done through the neck of the astragalus, but, proving insufficient, one was made on the outside of the foot and a wedge-shaped piece

of bone removed. This was effective, and when the patient awoke he "toed out." The result of the operation was extremely satisfactory. Dr. Bradford's paper showed that the treatment of these resistant cases had been a process of evolution, which had at last led him up to the point of *doing everything which is necessary.*

Dr. George W. Ryan thought the last speaker's remarks practically covered the whole field. The injunction to do "everything which is necessary" contains the keynote of success. What is necessary to be done is easily determined on the operating-table, and we have not done all until we are able to completely straighten the foot. There is one point not yet alluded to. In young children after the foot has been over-corrected, there is a constant tendency for the child to "toe in," and this, in his experience, was the hardest thing to correct. It would not do to wait, as Dr. Judson advises, until the child is able to walk, and then teach it how to walk; at least, this would be too much for the patience of Western people. He could not understand how Dr. Judson could get along without using an apparatus which extends above the knee, for very often in the after-treatment of club-foot he found it necessary to use such a splint, and sometimes even a hip-band. An apparatus extending up to the upper third of the thigh will not infrequently overcome the rotation which is really the cause of the toeing-in. It had been stated by Dr. Phelps that such and such views were old, and that he had expressed them ten or twelve years before, but even at that time they were not original; they were as old as club-foot itself. Dr. Bradford's paper was a valuable one, inasmuch as it gave the results of the different operations and of different methods.

Dr. L. A. Sayre remarked that by reference to his book there would be found an apparatus having a pelvic band, and an Archimedean screw, which would effectually overcome the difficulty spoken of by the last speaker.

Dr. B. E. McKenzie said that he also had found it very difficult to overcome this toeing-in, and the suggestions made so far did not seem to meet the case, for he did not see how this rotation could be prevented by the methods described. Is this deformity

corrected by causing external rotation at the hip-joint and making the child walk with the knees out? He had been particularly interested in the allusion which had been made to cutting or fracturing the bones of the leg, so as to correct the rotation where it actually occurs. The toeing-in occurs partly at the mid-tarsal joint. They had seen in one of the cases at the Hospital for the Ruptured and Crippled a very sad instance of carrying the over-correction too far. The boot, which he had already described and exhibited, seemed to him to be an excellent precautionary measure against the in-turning of the foot.

Dr. H. A. Wilson said that there was a long series of cases where the varus persists after apparent correction of the anterior part of the foot, and in these it will be found that it is generally the result of the application of considerable force to the anterior part of the foot alone, by which means the force has terminated at the proximal extremities of the metatarsal bones and has expended itself on the tarso-metatarsal joint, making an apparent correction of the front part of the foot and leaving a decided varus of the heel. In mildly resistant cases he had found it of service to swathe the foot in a wet bandage, thus distributing the force more equally. Dr. Hopkins, of Philadelphia, has devised an arrangement, consisting of four planes and a series of small rollers, fitting into an artificial heel, and so constructed that when the person steps squarely on the heel the foot is immediately everted. It was a question, however, whether the action of this apparatus is entirely in the ankle, as intended, or whether it is not communicated from the knee or hip-joint. It certainly overcomes completely the appearance of pigeon-toe.

Dr. R. H. Sayre said that the remarks of Dr. McKenzie concerning the case of over-correction which had been exhibited, had reminded him of the liability of valgus occurring after operations for varus, and this is due, as Dr. Wilson has said, to the force being so applied that the deformity is corrected without reference to the anterior part of the foot. Judging from the age of the boy and the time of the operation in the case referred to, he would suppose that the cutting operations had not been very extensive, and that

correction had been produced largely by the application of force. The case seemed to him to be a suitable one for section of the ligaments around the ankle-joint, and this would have obviated extensive tearing of the supporting structures in the sole of the foot, which, in his opinion, was responsible for the flat-foot from which the boy now suffers. He had seen other cases in which the reduction had been accomplished by the exercise of considerable force, the eversion of the toes being produced at the expense of breaking down the arch of the foot. The in-toeing is not always due to uncorrected deformity in the foot itself, as there are not a few instances in which there is a general distortion of the whole extremity. Having put the foot in the normal relation to the ankle-joint, if still not symmetrical, our efforts should be directed to that part of the leg in which the remaining deformity really exists. In young children, by holding the foot in proper position and directing their weight upon it, these upper curves sometimes correct themselves; in older cases osteotomy or osteoclasis is indicated, in order to put these parts in their normal relationship.

Dr. Samuel Ketch said that in referring to the etiology of club-foot he had spoken of the theory of rotation, not of the foot alone but of the whole extremity. This rotation does not wholly disappear at the time of birth, and in very many cases of equino-varus we not only have to encounter the trouble in the foot itself but in the hip-joint. A careful examination of cases of club-foot will show that in the majority of them there is a certain amount of deviation of the patella. In a paper which he read in 1885, he had named this in-toeing "residual varus." In endeavoring to overcome this we must, as Dr. Sayre had said, extend some form of retentive apparatus up to the hip-joint, not to act on the foot but upon the rotators of the thigh.

Dr. Royal Whitman said that the case of over-correction to which allusion had been made came to the hospital at the age of two months, and, not being a very severe case, was treated by the usual apparatus. There were no further notes of the case for two years, when it was stated that the deformity had not entirely been corrected. The present condition of flat-foot is said to have been

of recent occurrence. In many cases exhibiting the pigeon-toe it will be found that the great toe is more than usually strong and tends to draw the foot inward, and, consequently, when braces extending up to the hip-joint are applied, by turning the thigh outward they place the toe at a disadvantage, and may therefore be of service in restoring the normal muscular balance. Pigeon-toe is not only an accompaniment of club-foot but of weak foot, and is an effort of Nature to prevent the increase of an already existing deformity.

The discussion was here interrupted for a moment to allow Dr. Judson to exhibit a patient wearing his brace. He called attention to the great importance of having the upright of the brace flexible.

Dr. R. H. Sayre remarked that the case showed, when the knee is bent, that there is marked eversion of the foot, indicating that the thigh participated in the deformity.

Dr. A. B. Judson said that he considered that the whole limb was inverted, and his only treatment was to instruct the patient as to the proper manner of walking.

Dr. John Ridlon, continuing the general discussion, said that it would be undoubtedly more humane to operate with the wrench while the patient was anæsthetized, but those who had treated large numbers of dispensary patients had found it inconvenient, if not wholly impracticable, to carry out such treatment with anæsthetics; and besides this, it must be remembered that the wrenching is done very rapidly, and only a partial correction made at each treatment. Those who had actually employed this method of treatment could alone understand fully the reason why Thomas and his followers insisted upon the patient not being anæsthetized.

Regarding the alleged unfairness of Dr. Bradford's criticism, he wished to say that he did not think any member of the Association imagined for an instant that Dr. Bradford would be unfair to any member of the Association, or to anyone else; and if he seemed to be so, in not mentioning Dr. Phelps's name in connection with the open incision, it could only be attributed to an oversight, com-

mitted in the course of some hurried remarks. Moreover, he felt sure that he would give Dr. Phelps all the credit he might claim, whether it were due to him or not. On the other hand, he thought Dr. Phelps had placed Dr. Bradford's remarks in an unfair light, when he said that Dr. Bradford advises bone operations as a rule, for the speaker was sure this was not the case. At any rate, Dr. Bradford's paper could claim *some* originality, for the author emphasized by his statements, as well as by the sole-tracings exhibited, more than had been done by anyone previously, the importance of thoroughly correcting the lateral deformity and of making the lines through the heel and through the front part of the foot coincide.

Regarding the operative case which Phelps had exhibited, it must be said that while the result is not that which Bradford claimed was desirable, it is one which is entirely satisfactory to the patient and his family, and to the speaker. He believed thoroughly in treating these difficult cases according to the steps laid down by Dr. Phelps, but he would like very much to have some more definite rules to guide him in making a prognosis. How may we know, at the beginning, if one or all of these steps will be required in a given case, or how can we know when one or more of these steps have been previously taken, whether all has been done or not? Take, for example, the case just referred to. When first seen by the speaker, the patient was a young infant, and he thought subcutaneous tenotomy would be sufficient to effect a cure. A year or more later the child was taken to Dr. Sayre, who also said tenotomy was the proper measure, and, according to the father's understanding, expressed the opinion that this was all that would be necessary. The speaker then performed tenotomy, but the case relapsed; and when the child was again brought to him last spring, he referred it to Dr. Phelps, thinking the open operation would be required. In another case, which he first saw when it was only six weeks old, he believed that manual stretching and the Barwell dressing would be sufficient; but although this treatment was faithfully carried out, the deformity would recur. When the child was old enough to walk, he applied Judson's brace, and then successively: plaster-of-Paris; wrenching, according to Thomas's method; then plaster again; then subcutaneous tenotomy in the heel and

sole; then stretching according to Shaffer's method; yet when the child was two and a half years old, the deformity was quite as bad as when he first saw it. Then Dr. George S. Huntington performed Phelps's operation, dividing all the resisting tissues and putting the foot up in plaster. Again, Dr. Judson's brace was employed; and after about a year and a half more, Dr. B. F. Curtis excised the astralagus, and then the cause of the trouble was discovered. Not only was there the usual twist in the astragalus, but the surface of the astragalus which articulates with the tibia, instead of being rounded and looking in the normal direction, was flat, and looked backward and upward, and the posterior portion of the tibia articulated with the os calcis. Since this operation there had been no relapse. He would be glad if those experienced in operative treatment of club-foot would tell us how we can determine what operation, or how many operations, may be necessary in a given case.

Dr. Phelps said that the foot of Dr. Judson's patient would be held out in better position if the apparatus extended above the knee. In the left limb there is an inward twist of the tibia. In such a case all the contracted parts should be divided by open incision, and then an osteotomy performed on the tibia. In this way as good a result would be obtained as the other methods would yield in one or two years.

He claimed that Dr. Bradford was only unfair in one thing, namely, in saying that the sensitiveness of the sole was due to the operation. As to the question of priority, he would only say that the *method* of operating which he laid down many years ago harmonized completely with the ideas expressed in the paper; and notwithstanding what Dr. Ryan had said about there being no originality in the whole affair, he unquestionably had a right to claim priority in laying down *principles* of operation. Go back as far as one would, the road would be found strewn with failures, purely the result of disregarding the principles and method which he had insisted upon. If the treatment were carried out in this way, step by step, there should not be a succession of failures, such as had been pictured by Dr. Ridlon. During the first six months, when relapse is most liable to occur, a rigid plaster dressing should

be used. When such a position is obtained that each step tends by the weight of the body to overcome the deformity, there is little danger of relapse.

Dr. Griffith asked if Dr. Phelps had had in his cases, after the open incision, any instances of paralysis of the feet.

Dr. Phelps replied that even in extreme operations the only soft parts likely to be cut are: the tendo Achillis, the long flexors of the toes, tibialis posticus, abductor pollicis, the flexor brevis, the plantar fascia, the deltoid ligament and its branches. Occasionally one may go deeply enough to cut the internal plantar artery and nerve, but the external plantar artery and nerve lie external and do not need to be cut. It is better to cut than to stretch important nerves. After section of important nerves, there may be temporarily a numbness of the foot, but, according to his experience, within three months perfect sensation would be restored.

Dr. Ketch hardly thought the steps in the operative treatment of club-foot, as laid down by Dr. Phelps, were worthy of being called a "law." Dr. Ridlon's case would seem to indicate that there was no "law," and also to point out the need of more study of the anatomy of the parts, so that we may know what part should be attacked first. He knew of no law which would govern anyone in the treatment.

Dr. Charles C. Foster considered that club-foot was the result of a destruction of the balance of action of opposing tendons, by which the foot is drawn out of shape. The bones secondarily adapt themselves to this deformity. There can be no assurance that a relapse will not occur until this balance of muscular action has been restored. This point is frequently lost sight of, or else there would not be so much said about shutting up the foot for several months at a time in a plaster bandage.

Dr. McKenzie had derived much satisfaction from the open operation, but he had found that by first cutting the tendo Achillis

much leverage is lost, and the difficulty of correcting the in-turning of the anterior portion of the foot thereby increased. He had therefore modified the procedure somewhat, aiming at the first operation only to correct the condition of the foot *per se*, and then, after a few weeks, when the first wound had entirely healed, performing a tenotomy of the tendo Achillis, correcting the equinus. If you begin by cutting the tendo Achillis, the only posterior lever is the os calcis, whereas if this tendon be intact the os calcis is almost continuous with the leg. Dr. Phelps had objected to this modification on the ground that the foot was so weakened under these circumstances that, when used as a lever subsequently, there is not sufficient power to correct the equinus. He could only say in reply to this, that he had never experienced any trouble from this source.

Dr. Phelps replied that in nine cases out of ten it made no difference, but in the tenth case, where there was a short posterior ligament, much difficulty is experienced, even with powerful machines, in correcting the equinus.

Dr. Hodgen asked if it were not true that in this tenth case the artery is drawn closer to the bone than usual.

Dr. Phelps said he had never observed it.

Dr. J. C. Schapps called attention to the feet of Chinese women as an instance of the effect of pressure on the feet, and remarked that pressure necessary to re-form a healthy foot is different from that exerted for the purpose of producing a deformed foot. The foot in the position of varus is spoken of as the foot in the position of prehension, yet the flexibility in the varous foot is much less than in the normal foot. By the application of a certain force the deformity is usually corrected, and at the same time this stretching force acts practically as a nutritive stimulant; but if the foot be rapeatedly sprained with the Thomas wrench it becomes a weak foot. If the deformity cannot be quite easily overcome by manual force, it cannot be reduced by instruments, for the foot is less tolerant of instrumental interference.

Dr. Whitman thought that in Dr. Ridlon's case the distortion of the astragalus did not exist originally, but was due to the fact that, as a result of constant relapses, the astragalus forced its way farther and farther forward. If the right-angled position had been secured and maintained three or four months earlier, it is probable that after two or three years the shape of the astralagus would have been found to be quite different.

SPONDYLITIS OF SECOND CERVICAL VERTEBRA, WITH REPORT OF CASES AND INSTRUMENT FOR TREATMENT.

By REGINALD H. SAYRE, M.D.,
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Spondylitis affecting the second cervical vertebra is, in my experience, very rare, and the cases I report to-day, coming so closely together and, in one instance, presenting so remarkable a deformity, seemed to me worthy of record.

The difference in the deformity of true torticollis and that of cervical caries, or fracture or dislocation of a cervical vertebra, is very marked, but nevertheless these diseases are very often confounded. In a case which I once saw the suggestion was made that tenotomy of the rigid muscles should be done under chloroform and the head twisted straight, the case being supposed to be one of torticollis from muscular contraction; yet in torticollis the face looks upward, the head is thrown backward, and the neck is rotated, while in caries the bend at the site of injury is often abrupt, the head is twisted sharply to one side, the neck is bent forward, and the face looks down. In fracture and dislocation, the sudden change in contour, as well as the history, should differentiate the case from torticollis. In both cervical spondylitis and torticollis, the compensatory lateral curvature of the dorsal spine is much the same. (See Figs. 3 and 6.)

In inflammation of the second joint of the cervical spine the anatomical construction causes the symptoms to differ from those presented when the lesion involves other vertebræ than the first and second. Ordinarily, the patient with spondylitis is glad to lie down, and finds great comfort from taking the weight of the head off the shoulders, and many times, even when recumbent, requires

very strong traction to be made on the head to give relief from pain, and I have seen a child suffer from such spasm of its respiratory muscles when the traction was slightly relaxed for an instant that it grew black in the face; and it appreciated the necessity of traction so much that it would beg not to have the straps of its jury-mast loosened if it saw you were going to touch them. When the disease attacks the atlas and the axis, however, we have an entirely different anatomical condition, and the recumbent position, by letting the weight of the head push the atlas against the odontoid

Fig. 1.

process of the axis, causes pain, while the upright position relieves it by taking pressure off the inflamed surface; for the same reason, the prone position is more comfortable than the supine, as the odontoid is thus better freed from pressure of its anterior surface on the anterior arch of the atlas.

The greatly increased danger attending disease in this region has long been recognized, and a number of cases have been reported of sudden death following the bursting of an abscess, or the compression of the cord, either from the breaking of the odontoid or the rupture of the transverse ligament weakened by disease. The very marked dyspnœa, suffered by one patient, and the great distortion of the neck, gave rise to grave doubts, in my mind, whether she would not die of sudden compression of the cord before adequate support could be applied. I was also fearful lest I might cause this result in my efforts to correct the deformity.

Case I.—J. T., aged eleven years; Cuban. This boy is of a delicate family. He himself had double congenital club-feet which were treated by my father when the child was young; also had congenital contraction of right hand. In March, 1892, he began to have pains in his neck, and his face turned toward the right.

Fig. 2.

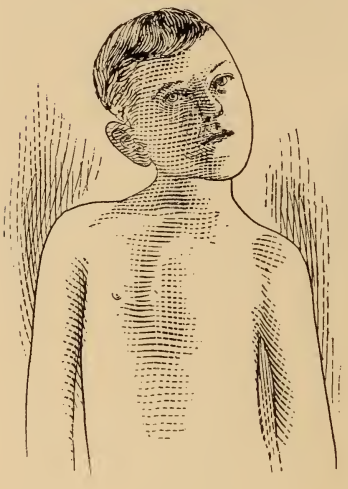
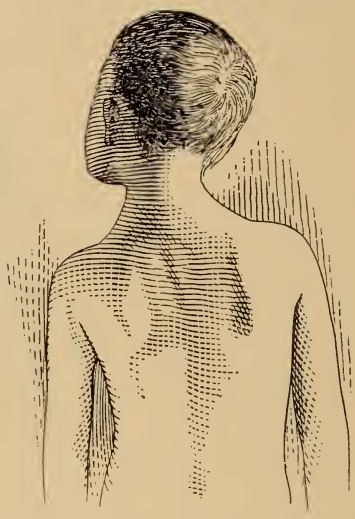


Fig. 3.



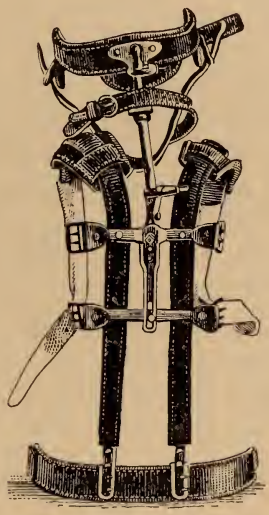
The pain increased, extending down both arms; afterward the pain diminished, but the head became more twisted. After a consultation in Cuba, the family physician referred the case here for treatment. On June 24, 1892, when first seen, the boy presented the appearance seen in Fig. 1. The face looked to the right, the left ear was drawn down, the head bent forward, and the chin depressed instead of elevated, as in torticollis, making a marked contrast in the position—as compared with Figs. 2 and 3—of a case of torticollis following meningitis which consulted me on the day before seeing the present patient. On the right of the second cervical vertebra there was a marked knuckle. There was great difficulty in swallowing or talking, and the teeth could not be opened wide enough to insert the finger, so as to feel the posterior wall of the pharynx, and it was, therefore, impossible to make out the

presence or absence of bulging there. Any movement of the head on the shoulders gave great pain. The muscles of the neck were very tense. The boy supports the head with his hand. Diagnosis: Tuberculosis of second cervical vertebra, possibly pharyngeal abscess.

Having at hand a modified jury-mast, which I showed in 1886, for holding the head in position after tenotomy for torticollis, I at once applied a plaster-of-Paris jacket, and, then, over a tightly fitting worsted foot-ball cap, put some plaster-of-Paris bandages, and fastened the jury-mast to the jacket and the head to the cup of the jury-mast, so as to hold his head quiet while I was having made an apparatus to allow the position of his head to be regulated.

The apparatus consists of two upright malleable steel bars which pass up the back on either side of the spine, and curve over the

Fig 4.



shoulders, on which they rest. Below, they are attached to a band passing half-way around the pelvis. Shoulder-straps and an apron hold this part of the apparatus in position. The metal is padded wherever it rests against the body. (See Fig. 4.)

At a point corresponding to the first dorsal vertebra a universal joint supports a rod, which is fastened by means of a similar uni-

versal joint to a head-piece. This rod has a ratchet and key movement for elongation. The head-piece consists of a padded piece of malleable steel, running from the base of the skull forward and upward, curving over each ear.

From the ends of this metal band, a leather strap, made adjustable by a buckle, passes across the forehead, and, by means of hooks, a strap is attached which passes under the chin. I had a strap passing from the front of the chin around the instrument at first, to prevent the chin-strap from slipping forward, but found it was not necessary, and removed it.

The universal joints at the back were used in place of three Archimedean screws, as I was anxious to have the apparatus completed as soon as possible, and this construction was more simple than the other. It has answered very well in these cases, but has the disadvantage of requiring two persons to regulate the position of the head with exactness.

The joint consists of a ball, whose surface is cut like a dental drill, and a socket in which it revolves. The latter can be tightened or loosened on the ball by means of a screw.

The apparatus is first applied to the body, the shoulder part being adjusted so as to make as equable pressure as possible. Both the universal joints are loosened, and the head part twisted to conform as nearly as possible to the head in its distorted position. The straps of the head-piece are then adjusted as tightly as comfort will allow, to hold the metal securely to the head. By means of the hands the head is then brought as nearly to the normal position as comfort will allow, and both the universal joints are tightened. The ratchet and key are then used to regulate the amount of upward pressure against the base of the skull until the patient is made as comfortable as possible. Every few days changes are to be made in the position of the head until it is brought as nearly to the normal position as possible.

Neither of the cases to whom I have applied this apparatus has required much longitudinal traction, and I think that if very great force were required for relief of pain, as is sometimes the case in inflammatiou in vertebræ lower down, the point of counter-pressure should be the hips and not the shoulders, as the latter cannot tolerate much pressure for a long time without inconvenience. The

forehead band is a necessity to keep the head in the apparatus, but must not constrict the head too tightly.

July 16*th.* The plaster-of-Paris dressing has been removed once, to improve position of head, and to-day was removed altogether, and the apparatus just described was adjusted. Mouth can be opened a little wider than when last seen. Temperature has always been subnormal when taken.

August 12*th.* Head much straighter. Prominence of second cervical vertebra much less.

16*th.* Can open mouth far enough to allow pharynx to be seen and felt. No abscess detected. Talks and swallows better. Position much improved. Leaves for home, wearing apparatus.

Case II.—S. A., aged eleven years. In the spring of 1891 had a swelling under the left jaw, supposed to be from a decayed tooth. In the winter of 1891-92 had pain in the head and neck. In February, 1892, the head began to incline to the left, at the same time a swelling formed under the left jaw. The swelling continued to grow larger for a month, the deformity meanwhile increasing, and in March her family physician, Dr. Alvarez, opened the swelling, which discharged a quantity of pus, and ran for about a week. The deformity grew rapidly worse. Was treated by electricity. Not improving, she went to the Hahnemann Hospital. Stayed there three days; nothing was done. In the meantime a swelling had developed to the right side of the second cervical spine. This was opened the first week in June by a physician, who failed to find anything. June 11th, she went to Mt. Sinai Hospital, where a diagnosis of malignant cervical disease was made. Then the case was referred to Dr. Gerster, who diagnosticated cervical spondylitis. The child stayed at the hospital twelve days. Nothing being done, she was taken home. Her mother then called Dr. Alvarez, who called me in consultation. From the beginning, in February, she complained of pain at night; cried in her sleep, and wanted to be lifted. During May she was obliged to sit up in a chair and lean her head forward on a pillow in order to sleep. In June, she began to have such great difficulty in breathing, that her mother thought she was going to die. Breathed with a curious, croupy kind of a crow. Also had some difficulty in opening her mouth.

When first seen by me the child walked with a careful tread, and was very apprehensive of the slightest attempt to move her head, which she kept constantly supported by one hand. Complained of pain at back of head and behind both ears. The head was bent sharply to the left, so that the left ear touched the shoulder, and the right clavicle was excoriated by the pressure of the chin. (See Figs. 5 and 6.) Her mother said she had not slept in bed

Fig. 5.

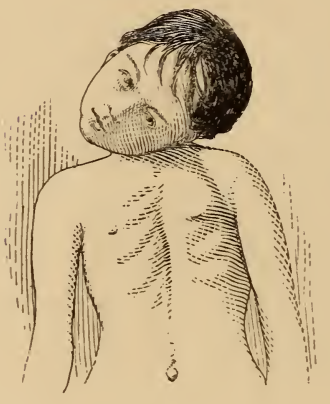


Fig. 6.

for more than two months, saying that it pained her too much to lie down, and all efforts to put the child in a horizontal position were violently resisted. She slept sitting in a chair, supported by pillows, and many times in the night would awake with a scream and complain of choking sensations, at which times she would lose her breath, and, from the mother's account, would seem to be dying. Lifting the head slightly, and raising it to a little nearer the normal position gave some relief, but the child could not be induced to lie down. As a temporary expedient, a towel was rolled into a wad and tied to the head with a handkerchief, steadying the head somewhat and placing it in a better position. In a day or two I applied a plaster-of-Paris bandage over the head, having first covered the head and neck with her undershirt, which I pulled up and cut to fit her, and thus made a sort of a helmet extending down over her shoulders on both sides and passing below her chin.

This dressing gave much relief and allowed her to sleep much better, but still she complained of intense pain and dread on attempting to lie down.

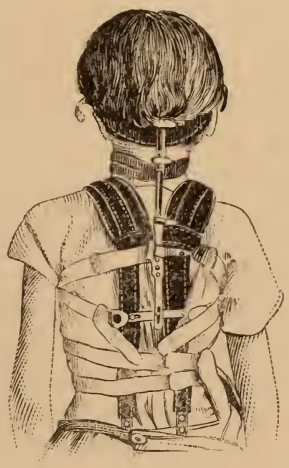
July 20*th.* Applied the brace described above, and found that the head could be put in a much better position.

30*th.* Child could sleep with head bent forward on the bed while she sat in a chair.

August 15*th.* Position very much improved. (See Figs. 7 and

FIG. 7.

FIG. 8.



8.) Runs and plays. Can sleep in hammock. Rarely cries out at night.

September 19*th.* For past week patient has slept in bed. Is free from pain, walks about without tenderness or dread. Can open her mouth well.

This apparatus I have since modified in a third case that I have recently seen by substituting three Archimedean screws for the roughened ball-and-socket joint at both points of rotation, and find it much more satisfactory—giving perfect control of the motions of the head, and, by pressing under the occiput and in front of the forehead, upward traction can be made, while the jaw is allowed to open better than in those forms of head support where all pressure is made under the chin and occiput.

CLUB-FOOT, WITH RARE COMPLICATIONS.

By A. J. STEELE, M.D.,
ST. LOUIS.

A. B., male, aged three years, afflicted with congenital double talipes equino-varus, extreme. In January last I operated on both feet, dividing subcutaneously the plantar tissues freely, and the Achilles tendons, using considerable force to over-correct the deformity, and put up the feet in gypsum bandage; they being previously enveloped in sheet-cotton, the toes being left exposed. Chloroform was used as an anæsthetic. In thirty hours the dressings were removed on account of the obstructed circulation, as shown in the discolored toes. Blisters had formed on both feet, which were dressed with weak carbolized oil, and freely enveloped in warm antiseptic cotton. The patient became feverish, lost his appetite, and complained much of pain. The circulation improved, but the parts swelled, and the inflammation involved all the deeper tissues of the feet. The tenotome wounds opened and suppurated, cellulitis became general through the feet, and septicæmia left the patient in a critical state. Free incisions liberated imprisoned pus; very little nourishment was tolerated, champagne alone being acceptable.

After a few weeks of strict antiseptic dressing, and sustaining general treatment, the local inflammatory processes subsided, the fever diminished, and the appetite improved. As splints could not be tolerated, the feet returned to their talipetic shape.

At the present time, now seven months since the operation, the inflammation has quite left the left foot; the sinuses have closed; the deformity is more aggravated than ever, the plantar scars having drawn the front of the foot very much inward. The right foot is less deformed, but is swollen and has two sinuses discharging, with evidence of roughened bone. General health improved.

Remarks.—Never before in my experience has such a train of symptoms followed the operation for club-foot. The parts had been washed with carbolic acid solution; the tenotome had been immersed in a 5 per cent. carbolic solution; cotton was freely enveloped around the parts previous to the application of the plaster bandage —that undue constriction might not occur—and the parts were promptly liberated on evidence of impaired circulation. There was evidently something back of all the local conditions determining the unfavorable and unusual turn that matters took.

La grippe was prevailing quite generally in the neighborhood at the time; the children in the institution where the operation was performed were afflicted with it, and I believe my little patient had it. Experience of surgeons in our town at that time showed that operations did poorly. A laparotomy under my own observation, doing well until the eighth day, suddenly took an unfavorable turn; the already united edges giving way, suppuration occurring, and death following. Stitch-wounds in nearly all cases suppurated. The silk supposed to be at fault was destroyed, and new was prepared with great care, but the result was the same. Operations did badly, so that only emergency cases received attention. Reports from Paris showed a similar state of affairs there, surgeons refusing operations unless absolutely necessary, because unfavorable terminations were so frequent during the prevalence of the epidemic.

It has been asserted that the "la grippe" germ is a pus-producing germ. Whether so or not, certainly operations in general, and my club-foot case in particular, did poorly, my patient just escaping amputation, and barely with his life.

The case, too, was interesting on account of cognate deformities—viz., six toes on each foot, two pairs of webbed toes on either side, and the digits irregular in size. One thumb was shaped and comported itself like an index finger, and there was a small pedunculated growth on the side of the same thumb; otherwise the child was normal and robust.

Note.—At the time of going to press, now four months since the above report was made, the left foot is straight and nearly healed, the Phelps operation having been performed three months ago. After the cut was made and the foot straightened, a fearfully

gaping wound was shown. This, however, in time filled with granulations; the foot being held in correct position with a plaster bandage.

The right foot still has a sinus opening near the tendo Achillis. Very soon now operation will be done on that foot, and the future may show two serviceable feet after prolonged and complicated disability.

ETIOLOGY OF THE VARIOUS DEFORMITIES OF HIP-JOINT DISEASE.[1]

By A. M. PHELPS, M.D.,
NEW YORK.

We are all familiar with the deformities which occur in the first, second, and third stages of hip-joint disease.

The typical deformities of each stage are: In the first, abduction, slight flexion, and outward rotation, with *apparent* lengthening; in the second, an exaggeration of the deformity which occurs in the first; while in the third stage the entire picture changes to that of flexion, adduction, inward rotation, and *real* shortening. In a considerable per cent. of cases erratic deformities are observed; such as extreme flexion with outward rotation and shortening of the affected limb, the deformity of the second stage occurring in the third. Abduction and shortening, without flexion, is sometimes seen.

This classification is made merely for clinical convenience, and relates only to semeiology.

Barwell says that we may conclude that the appearances indicate certain processes of disease, but with morbid anatomy the division into stages has no direct connection. I have adopted this classification of the deformities in my observations and in writing.

A limb with shortening from destruction of bone, I classify as belonging to the third stage, without regarding the deformity present. A limb with adduction, flexion, and inward rotation, I classify as disease in the third stage; even though there be no shortening. I have observed, in cases excised, that these deformities of the three stages, as already described follow very closely and quite accurately

[1] Abstract. The illustrations and mathematical problems are omitted owing to the shortness of time allowed before the publication of the *Transactions*.

interpret, certain pathological changes taking place in or about the joint.

The question under consideration is, What causes these various deformities?

1. *Why does the limb assume, nearly always,* the position of abduction, flexion, and outward rotation with fixation, in the first and second stages, and adduction, flexion, and inward rotation in the third stage?

2. *Why, in a small percentage of cases, the erratic deformities in the third stage—i. e.,* flexion, abduction, and outward rotation?

How shall we explain all these complicated deformities?

Barwell makes no attempt to explain these phenomena. I quote from his book:[1]

"While the muscles thus waste, the joint assumes a fixed position, natural in itself, abnormal only in its persistency toward the side of flexion. This is the case at the elbow, wrist, and ankle, while at the shoulder abduction pertains; at the knee an inward twist of the tibia is usually combined with considerable flexion; at the hip, very complicated positions, to be studied in a future chapter, are assumed. These postures assume in nearly every case of joint disease, almost with the certainty of an unchangeable law. There is, then, in all joint diseases a tendency of the flexor muscles to contract, while the extensors, if not in absolute relaxation, do not, at all events, retract sufficiently to annul such action.

"It is true that the flexors are probably, in all limbs, stronger than the extensors, but in fact a mere examination will show that on the flexor side muscles are rigid, and on the opposite side flaccid. Our knowledge is as yet insufficient to account for the phenomenon."

We will consider these statements later. The experiments of the Germans demonstrated that the joint being forcibly injected from within the pelvis, produced eversion, flexion, and abduction of the limb, and immobilization of the joint.

Sayre concludes from these experiments that effusions are present in the joints diseased, that this intra-capsular hydraulic pressure is the cause of the deformity in the first and second stages of hip disease.

[1] Barwell, p. 106. Wood's Library, 1881.

He says (p. 248): "The peculiar position of the limb gives to the second stage of the disease the name 'apparent lengthening,' but I prefer to designate it as the stage of effusion."

And he accounts for the deformity of the third stage, viz., flexion, adduction, and inward rotation, by the rupture of the capsule and the escape of the fluid, thus relieving intra-orbicular pressure. This, he claims, allows the leg to swing the deformity of the third stage. He says (p. 259):

"And rupture of the capsule takes place and the imprisoned fluid escapes into the surrounding tissues. When this has occurred the disease is in the third stage.

"The limb is now adducted, inverted, and flexed.

"The change in position is due to the fact that the fluid in the joint cavity has been evacuated.

"The distention of the capsule, which was the mechanical cause of the flexion and adduction of the limb, having been relieved, nothing now obstructs the free action of the adductors, and the limb is therefore adducted and inverted."

So far as I know, this hypothesis of the Germans, approved and indorsed by Dr. Sayre, is the only explanation we now have of the etiology of the various deformities of hip-joint disease. Barwell offers none; but makes, among others, a broad statement that "It is true that flexors are probably, in all limbs, stronger than extensors."

A moment's thought will convince us that this last statement is certainly an error.

In the knee-joint the quadriceps are much stronger than the flexors. This we have demonstrated in the course of our experimental work, and it will be published shortly. The same is also true of the hip-joint. The fluid hypothesis is certainly erroneous, for the following reasons:

1. A very large per cent. of cases of morbus coxarius are unattended by fluid effusions. Still, the same picture of deformity is seen as in those cases attended by large effusions.

2. We have observed in our clinics and have operated upon cases of extra-capsular disease in which the joint was not diseased, but the same picture of deformity presented itself.

Barwell says (p. 292): "While inflammation, or even suppura-

tion about the epiphysis of the femur arises, certain pains, forms of lameness, etc., are produced; while as yet there is no effusion or suppuration within the joint cavity; no morbid changes of the parts which form its walls. We have, namely, so-called symptoms of morbus coxarius, while as yet in the hip (joint) there is no disease."

3. Cases of suppurating joints, with large effusions, often take the erratic deformities of the third stage—*i. e.*, abduction, flexion, and outward rotation—even after the joint contents have discharged.

4. There can be no reason why, after the evacuation of the joint, the limb would not return to the deformity of the second stage instead of the third; because the three great glutei and outward rotators are stronger than the adductor group, unless the limb is flexed beyond twenty degrees. These are the chief, and I believe, valid reasons why the explanation of these deformities by the fluid hypothesis is incorrect.

During the past four years I have devoted much time to the study of the etiology of these deformities, not only of the hip, but of all the joints of the extremities, and have become fully convinced that as yet a correct explanation has not been offered.

After concluding several dissections of the hip-joint, I desire to place before you for your consideration and criticism the theories and hypotheses upon which we worked, and the couclusions at which we arrived.

It became necessary before any experimental work was performed, to carefully compile clinical data in a large number of cases. Assisted by Drs. Plympton and Greenway, these observations were made at our clinics at the University Medical College, and also at the Out-door Department and the Orthopedic Ward of the New York Post-Graduate School and Hospital, two places which afforded us ample opportunities for observation. The conclusions reached were:

1. That abduction always preceded flexion, or was attended by it, in the first stage.

2. Abduction and outward rotation are always present in the second stage. Flexion was nearly always present, but was absent in a few cases.

3. When the limb flexed beyond forty degrees, and frequently at a much lesser degree (twenty degrees), it quite rapidly passed to the

deformity of adduction, inward rotation, and flexion, whether the capsule contained fluid or not. (The degrees alluded to are from a horizontal plane.)

Exceptional cases exaggerated the deformity of the second stage for the third. In two or three other cases there was outward rotation, abduction, shortening with but slight flexion. In another case, observed by Dr. Plympton, adduction and outward rotation, without flexion, occurred with three-fourths of an inch shortening.

These observations, together with dissections which Dr. Greenway and I made, presented numerous problems which will be considered later. At the University dissecting-room, we made a series of dissections, estimates from which, I think a fair explanation can be given to every deformity which may occur in any case of hip disease.

The hip-joint is surrounded on its outer aspect by a mass of muscles running diagonally from the pelvis to the great trochanter from all directions. When the limb is in a straight position, the combined action of these muscles produces abduction of the limb. The capsule, when the limb is straight, is wound around the neck of the bone. The tension of this capsule, together with that of the Y-ligament, holds the head of the bone firmly in the socket and produces great pressure upon the joint. The group of glutei muscles are much stronger than the opposing group, the adductors—the proportion being 131 for the glutei to 116 for the adductor group. These conclusions were arrived at by weighing each muscle separately, measuring the triangle in which it acted, taking as a unit of strength the gluteus muscle, weighing two and a half pounds, and capable of doing fifty pounds work. The rule which I followed was that laid down by Houghton (see Houghton's *Principles of Animal Mechanics*, page 183, from which I quote):

"The work done by the same (a triangular) muscle will be proportional to double the perpendicular let fall upon the side of a triangle from the foot of the bisector of the vertical angle."

Assuming the work of the gluteus maximus operating in a given triangle with two pounds and a half of weight to be fifty pounds, other muscles operating in different triangles of different weights can be accurately estimated as to their comparative strength. Following this rule, I found that the glutei muscles were capable of one hundred

and thirty-one pounds, whereas the adductors were only capable of one hundred and sixteen pounds, proving that the abductor group was much stronger than the adductor in the subject examined. From our clinical observations, I at once concluded that the reason why the limb went over to the deformity of the third stage of hip-joint disease was because the actions of these muscles were all changed by the flexion of the limb, or from pathological destruction of the joint changing or annulling the action of the muscles by destroying the leverage.

When the limb becomes flexed, *the adductor group begins immediately to lose its power as adductors and in proportion to flexion become inward rotators; the outward rotators become abductors* when the limb is flexed to an angle of about forty degrees, with the exception of the quadratus femoris and obturator externus. This brings us to a consideration of the problem before us.

Question 1. Why, in the first stage, is the limb slightly abducted, outwardly rotated, and flexed with apparent lengthening?

Answer. A voluntary effort on the part of the patient to relieve tension of the capsule and Y-ligament.

Question 2. Why does this deformity increase, constituting the second stage of the disease?

Answer. Spasm of the muscles about the hip-joint is present. The great glutei, outward rotators, tensor vaginæ femoris, and flexors have the advantage of leverage (being irritated and affected by spasm, and aided by a voluntary effort, or non-resisting effort of the patient, the same as in the first stage) and thus the limb still exaggerates the deformity of the first stage.

Question 3. As a rule, with an occasional exception, why do limbs assume the deformity of the third stage only after flexion to twenty-five degrees has taken place?

Answer. Because *after the limb passed to twenty-five degrees of flexion, the abductors to a very great extent become internal rotators;* the external rotators almost totally lose their power as external rotators, and become abductors (with the exception of the quadratus femoris and obturator externus), and *the tensor vaginæ femoris becomes a powerful inward rotator. Resistance or antagonism to the powerful abductors and flexors of the thigh being modified or annulled by*

flexion, the limb must pass to the deformity of the third stage, namely, adduction, flexion, and inward rotation.

Question 4. Why did some cases in the third stage of the disease continue the deformity of the second stage?

Answer. These may be, and usually are, cases characterized by great abduction and outward rotation from the commencement of the disease, or soon after. The head of the bone is thrust forward against the anterior and upper border of the acetabulum, cutting it away, producing a partial dislocation forward. This extreme abduction puts the adductors on the stretch and partially paralyzes them by tension. The adductors and outward rotators become permanently contractured, adhesions form, and the limb is held in this extreme position of deformity of the second stage in the third.

I have excised two cases of this deformity, and in both cases the head of the bone had perforated the acetabulum anteriorly and superiorly, and the bone was held firmly against the pelvis by bands of adhesions.

Dislocations may take place anteriorly or posteriorly: posteriorly often from large effusions, or pathological cause, but anteriorly from destruction of the anterior border of the acetabulum, due to the action of the external rotators and glutei muscles. *The shortening of the neck of the femur destroys the action of the flexors,* and often the abductors *by changing the leverage.*

Question 5. Why did one of the cases have adduction, outward rotation, and shortening without flexion?

Answer. Because of the destruction of the head and neck of the femur or the passing of the head through the acetabulum. This destroyed the leverage of the glutei and flexors, which gave the adductors full power to adduct while the external rotators still acted.

Nerve distribution within the joint undoubtedly plays an important part in producing special action of groups of muscles, depending upon the location of the lesion. For example: in the knee joint flexion is never seen in disease of the patella alone. This is due to the fact that its nerve supply is derived from the anterior crural, which trunk supplies the extensors of the limb and not the flexors; whereas flexion occurs in disease of the condyles, the nerve supply of which is derived from the great sciatic, which nerve trunk supplies the flexors and not the extensors of the limb.

Conclusions.

Normal or typical deformities are produced by change of leverage and action of muscles due to—

1. A voluntary effort.
2. Involuntary spasm or contraction.
3. Nervous irritation of groups of muscles due to location of lesion in or about the joint.

The erratic deformities are produced by change of leverage due—

1. To pathological causes, *e. g.*, destruction of bone, head, neck, or acetabulum.
2. Nervous irritation of groups of muscles, due to location of lesion in and about the joint.

The pathological causes of erratic deformities are—

1. Shortening of the neck and head of the femur.
2. Perforation of the acetabulum.
3. Shortening of the limb from either of the last-named causes.
4. Burrowing of pus through groups of muscles either irritating them to contraction or destroying them.
5. Dislocations from destruction of bone.
6. Dislocations from large effusions.
7. Cicatricial contractions binding down and restricting the limit of motion of the femur.

The explanations of the cause of the deformities existing in hip-joint disease is applicable to every joint in the body, and very soon I will publish the result of experiments on all the other joints. This paper will appear with the illustrations of dissections and the scientific work in one of the metropolitan journals as soon as the work has been completed.

DISCUSSION.

Dr. L. A. Sayre said that the Association owed a great deal to the laborious research which had been embodied in the paper just presented. The dissections seemed to prove conclusively that the deformities in question are caused by muscular contractions, and, at any rate, the author's explanation is far ahead of any former one.

Dr. Royal Whitman did not think the author made it clear how outward rotation, which presses the head of the bone against the anterior part of the capsule, diminishes the tension. He would also like an explanation of the psoas contraction of Pott's disease, in which there is the same flexion of the leg to the point described, without the production of the characteristic deformity of the third stage of hip-joint disease.

Dr. Robert W. Lovett said that the author's solution of the mechanical problem presented was very satisfactory. His own experience, however, had been that the deformity of the early stage was not so uniformly present as would appear from the paper, and that the so-called "erratic forms" really constituted a fair proportion of all the cases.

Dr. A. B. Judson also thought there were frequent exceptions to the deformity which is considered to be characteristic of each stage. He had always explained the existence of deformity, satisfactorily to himself, by supposing that the limb took whatever position gave the most freedom from pain in the habitual attitudes assumed by the patient in daily life. For instance, in the first stage, the patient stands on the well foot, and takes the military position of "at ease," namely, adduction and slight flexion. Later on, when the pain on walking is more marked, the limb is drawn from the ground in order to give the other limb a better chance to act in progression, and to protect the affected limb from contact with the ground. This gives flexion with adduction and apparent shortening. Still later, in a neglected and serious case, the patient assumes the position of extreme flexion, adduction, and flexion at the knee. While appreciating very highly Dr. Phelps's painstaking investigation, the explanation just given was satisfactory to his mind.

Dr. John Ridlon had understood the author to assume that in the erratic forms there must be extensive bone destruction, whereas he had in mind cases of this kind in which there had not been extensive bone destruction or dislocation, as demonstrated by the reduction of the deformity and the results of treatment. For this reason he thought the author's theory was defective as regards these

erratic forms, although the typical deformities were well explained by it.

Dr. Roswell Park thought it possible to explain by this theory, much better than by the older one of intra-capsular pressure, many of the phenomena of joint disease. Referring to the erratic forms, he said it was unfortunate that hip-joint disease should have been conventionally divided into three stages. Assuming that the majority of cases of so-called morbus coxæ were due to tubercular foci in the bone, just in proportion as the focus of disease—supposing it to be a single one—is nearer to one side or the other, the group of muscles nearest to the centre of disturbance will become the most contracted and involved, even before actual or pathological destruction occurred. This explanation he considered to be sufficient to account for the phenomena observed.

Dr. Halsted Myers thought he had also seen cases similar to those referred to by Dr. Ridlon, in which, although the limb was flexed to more than twenty degrees, there were no adduction and inward rotation. Admitting that the general tendency of the muscles about the hip-joint was to act in the manner described in the paper, he would like to ask how the power of these individual muscles had been estimated; for until their relative strength had been carefully calculated, no trustworthy conclusion could be drawn concerning their opposing actions.

Dr. Henry Ling Taylor said that no one present could fail to be struck with the beauty of the demonstration which they had just witnessed, but its very simplicity made one inclined to doubt its ability to explain all the phenomena. In the production of deformities around the hip-joint, there are certain forces acting on a lever from a fulcrum. In the author's argument, he assumes that the different muscles are subjected to about the same amount of traction or tonicity. This may be permitted as a starting-point in order to simplify the explanation; but he afterward modifies this to explain special conditions, by supposing that the fulcrum is changed by extensive bone destruction. We must, the speaker thought, further modify it by assuming that the tonicity of the special groups of

muscles is changed by special sources of irritation. Personally he inclined very strongly to the theory that the production of these deformities depends upon reflex phenomena, and not on the voluntary modification of the tonicity of the muscles to such a degree as would be suggested by Dr. Judson's remarks. The fact that these deformities occur to about the same extent whether the patient is walking about or is in bed, would seem to be confirmatory of this view. He was prepared to accept, in a general way, Dr. Phelps's beautiful demonstration, but it must be modified very considerably to explain special phenomena. He agreed entirely with the last speaker in believing that the deformities of the three well-marked stages are somewhat misleading, and that there are many exceptions to these artificial divisions.

Dr. Samuel Ketch congratulated the author, both on his work and the method adopted. We had long been content to explain the deformities occurring about the hip-joint on the theory of reflex muscular contraction, and whether the new theory just presented to us proves adequate to explain all the phenomena or not, it is certainly a decided step in advance. All the hypotheses which had been heretofore presented depended largely on their author's special notion regarding the pathology of hip-joint disease. The theory that the location of the disease would produce certain deformities seemed to the speaker untenable, and it certainly has not been proven. The mechanical theory, to his mind, came much nearer the truth.

Dr. E. H. Bradford said he had nothing to say, further than to express his congratulations to the author for his remarkably beautiful and satisfactory demonstrations.

Dr. R. H. Sayre said, that although he appreciated the beauty of the demonstration, the paper had failed to convey to his mind a clear idea of the etiology of the various deformities about the hip-joint. We had been shown how the same muscle may be at one time an extensor, at another an adductor, and at another time an inward rotator, depending upon the position which the limb assumes with reference to the trunk; but we had not been told why, in diseased conditions, certain muscles predominated over others and distorted the limb, irrespective of the volition of the patient. The

author's theory that the position of the limb in the first stage of hip-joint disease is the one in which the Y-ligament is relaxed, and the pain least, is very similar to the German theory, that when the joint is distended with fluid, the limb is flexed and everted to relax the fibres of this Y-ligament. But this does not explain why, in some cases of hip-joint disease, there is at an early stage very little flexion and very marked eversion of the foot, while in others there is very little eversion and very decided flexion. What is the difference in the pathological condition in these cases which causes this difference in attitude? The theory that these different attitudes are due to different positions of the focus of disease cannot be correct, because in the knee the focus may be in one or the other condyle, or under the patella, and yet he had never seen a knee-joint recover with eversion of the toe and adduction of the leg. In all the cases of disease of the knee-joint which he had seen, there had been eversion of the foot and abduction of the shin, irrespective of the location of the focus of disease; and reasoning from analogy, he would suppose that a change of position of the disease focus in the hip would not account for these different distortions of the limb. Similarly, in ankle-joint disease, whether the focus of disease be in the internal or in the external malleolus the toe is very strongly flexed. The beautiful equipoise of the elastic bands in the manikin did not represent the true condition found in nature. Again, the author has told us that the reason we have abduction and eversion, instead of adduction and inversion, is because of extensive destruction of the acetabulum and the head of the bone, yet he had seen cases, such as those referred to by Dr. Ridlon, which did not seem to bear out this theory. We had not, the speaker thought, yet reached the groundwork of the etiology of these deformities.

Dr. A. J. Steele said that the author's theory turns entirely upon the changes in the actions of the muscles; that with a certain degree of flexion in the early stage of hip disease, we did not have *hip-joint* disease; that the inflammation is in the head of the bone, and may not yet have extended to the joint proper, and, therefore, there is no congestion in the joint, and no probability that the tension of the anterior fibres of the capsular ligament, by pressing upon the joint, will cause pain; and yet, in that early stage, when the disease is far down in the bone and is not yet in the joint, the

patient *does* flex the limb. How is this to be explained? The speaker inclined to Mr. Marsh's opinion, that the patient voluntarily assumes the position of greatest ease.

Dr. Phelps, in closing the discussion, said that his paper was only a preliminary contribution, and did not pretend to claim a solution of all the problems connected with joint disease. Regarding the forward dislocation from destruction of the bone, he would only say that in cases which he had excised he had found this condition present—this was good as far as it went. Complete explanation had not been found for the erratic forms, and a solution of this problem must be left for future study. Dr. Whitman asked for an explanation of why there should be outward rotation alone; he could only answer, that he had never seen a case in which this condition existed alone. The same gentleman asked about the position assumed when a psoas abscess is present. Here, the muscles of the joint are not affected by spasm, as they are in hip-joint disease, the psoas contraction being due to a psoitis from burrowing of pus. Regarding the frequent occurrence of what he had called "the erratic forms," and also regarding the location of the disease, these were points which could not be discussed further at the present time. The cases he had seen showed destruction of the bone; there might be other conditions, such as inflammatory adhesions and burrowing of pus, and an affection of the nervous supply of the joint; but these, although touched upon in his paper, had been omitted in reading. The question of the nervous supply is an important one in this connection. He had also omitted reading from his paper the long and rather intricate calculations which had been made, and which fully answered the question raised about the power of the different muscles. The erratic deformities were due to dislocations, destruction of bone, change of leverage, adhesions, or the like; the exact conditions can only be determined by further investigation. Anyone who had observed an osteomyelitis of the shaft of a bone must have noticed that the bone externally is congested over the seat of the inflammation; hence, when the inflammation is extra-capsular, the joint is congested, even though it may not yet be involved in the disease process. Spasm of muscles is present from the onset of hip-joint disease to its end.

OBITUARY.

BUCKMINSTER BROWN, M.D., M.A.O.A.

By CHARLES C. FOSTER, M.D.,
CAMBRIDGE, MASS.

Mr. President and Gentlemen: By the death of my old master, Dr. Brown, orthopedic surgery has lost one of its pioneers in America, and one of its brightest lights. Well known to most of the older members of this Society, and to many of the leading English surgeons, with whom he corresponded regularly, increasing physical weakness, and reticence of tongue and pen, prevented his coming much in contact with the younger generation. I, for ten years his pupil and assistant, know what his work was—how, for nearly fifty years, he practised and studied, feeling his way, from the time when Stromeyer had just given us subcutaneous tenotomy to the present day. For many years he stood alone, there being nobody nearer than New York who could aid him in a difficult case. Orthopedic surgery had not then the standing it has now, and the orthopedist sometimes met with opposition rather than help from colleagues who looked upon him and his methods with suspicion. But Dr. Brown's surgical knowledge and skill, his mechanical ability, and his personal character were soon appreciated, and his professional position was firmly and permanently established.

Buckminster Brown was born in Boston on the 19th of July, 1819. Among his ancestors on both sides were many eminent medical men. His paternal grandfather was a well-known physician of inland Massachusetts. His father, Dr. John Ball Brown, of Boston, was the first surgeon to introduce subcutaneous tenotomy into

New England. He gave much attention to orthopedics, and maintained a private orthopedic hospital. His maternal grandfather, Dr. John Warren, was one of the founders of the Harvard Medical School, and its first Professor of Surgery.

Dr. Brown graduated from the Harvard Medical School in 1844. In 1845 and 1846 he visited Europe, walking the hospitals and studying orthopedics—in London under Dr. J. Little, in Paris under Guérin and Bouvier, and in Germany under Stromeyer. On his return to Boston in 1846 he at once established himself as a physician, and began his life's work.

Orthopedic surgery was then in its infancy in New England. Dr. Brown's interest in this branch of his work constantly increasing, and his practice becoming more extensive and absorbing, he gradually relinquished general practice and devoted himself to his specialty, his patients coming from all parts of the United States and the British Provinces.

He married, in May, 1864, Sarah Alvord Newcomb, daughter of Mr. Joseph Warren Newcomb, and great granddaughter of General Joseph Warren.

Thoroughness and patience characterized all of Dr. Brown's work. He never began upon a case until he had planned his whole campaign. Treatment, once begun, was carried out in every detail, and continued as long as might be necessary. He never gave up, no matter how discouraging and intractable a case might be, but persevered until it resulted as he had expected it to do.

He had the faculty of impressing upon his patients and their friends the importance of the various methods employed, and thus secured their hearty and persevering coöperation. As a surgeon, his patients trusted him implicitly; as a man, they loved him and never forgot him. Some of his old patients corresponded with him for years. At the time of his death several of them came long distances to attend his funeral, and many others sent letters of condolence.

His courage and fortitude are amply attested by his life's work of nearly fifty years of practice, accomplished in spite of constant suffering and physical weakness, that obliged him to economize every ounce of strength for his work. Refined, sensitive, fond of art, music, and the theatre, he gave up almost all recreation except

books and driving. His own suffering taught him to understand that of others, and to sympathize with them.

Dr. Brown was an orthopedist in the best and broadest sense of the word, using all means—operative, mechanical, and medicinal. Conservative by nature, he was yet ready to adopt any new method as soon as its value was clearly proved. He followed carefully the work of surgeons, both native and foreign. Confident in his own skill, in his long experience, and his well-tried methods, he quietly watched various procedures taken up by the profession with enthusiasm and gradually allowed to pass into oblivion.

His mechanical ability was great, and his surgical dexterity was equally remarkable. His operating and his whole handling of a case were characterized by a certain delicacy and finish that I have seen in no other man's work. His favorite quotation was, "Genius is the talent for taking pains." He certainly took great pains in putting the final touches to a case—adding a polish, so to speak, after the essential result had been secured. His sense of touch was very keen, and he learned much through the ends of his fingers. To watch him as he manipulated a contracted tendon or a carious spine was an object lesson.

Always a retiring man, Dr. Brown never pushed himself. He let his work speak for him; and how extensive that work was few persons know. His extremely quiet manner and unwillingness to speak of himself might mislead a stranger, but all who knew him well appreciated his far-seeing wisdom. He never published an article unless he had something to say that he thought of more than temporary value, and he destroyed many articles unpublished. He left an almost finished book on lateral curvature, a branch of work in which he had been particularly successful.

He felt a deep interest in this Association, and expected much progress would result from our conferences. Whenever I returned from a meeting he would question me closely concerning all that had been said and done, expressing the keenest regret at his inability to be present. Even during his last illness he spoke to me of the recent meeting at Washington.

Dr. Brown was a member and Councillor of the Massachusetts Medical Society; member and Librarian of the Boston Society for Medical Improvement; member, Secretary, and Treasurer of the

Boston Medical Association; and member of the Massachusetts Medical Benevolent Society. He was for nineteen years surgeon to the House of the Good Samaritan.

In his will he left a large sum of money to the Harvard Medical School, to found a Professorship of Orthopedic Surgery; and also left to the School his library and his collection of casts and photographs.

He died at Auburndale, Mass., on the 24th of December, 1891.

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